AF /IW

DOCKET NO. 2002.01.005.WS0
Client No. (SAMS01-00168)
Customer No. 23990

OIPE IAP64 FEB 14 2006 PATENT & TRADEMARK OFFICE

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Purva R. Rajkotia
U.S. Serial No.:	10/028,571
Filed:	December 20, 2001
For:	SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK
Group No.:	2687
Examiner:	Eliseo Ramos-Feliciano

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

Sir:

The undersigned hereby certifies that the following documents:

1. Appeal Brief ;
2. Check in the amount of $500.00 for the Appeal Brief Filing Fee;
3. Fee Transmittal for FY 2006 (in duplicate); and
4. A postcard receipt;

relating to the above application, were deposited as "First Class Mail" with the United States Postal Service, addressed to Mail Stop Appeal Brief - Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on February 10, 2006.

Date: Feb 10, 2006 — Kathy Hamilton
Mailer

Date: 10 Feb 2006 — John T. Mockler
John T. Mockler
Reg. No. 39,775

P.O. Drawer 800889
Dallas, Texas 75380
Phone: (972) 628-3600
Fax: (972) 628-3616
E-mail: *jmockler*@davismunck.com

OIPE IAP64 FEB 14 2006 PATENT & TRADEMARK OFFICE

PTO/SB/17 (12-04)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2006

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 500.00

Complete if Known	
Application Number	10/028,571
Filing Date	December 20, 2001
First Named Inventor	Purva R. Rajkotia
Examiner Name	Eliseo Ramos-Feliciano
Art Unit	2687
Attorney Docket No.	2002.01.005.WS0 (SAMS01-00168)

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ____________

☑ Deposit Account Deposit Account Number: 50-0208 Deposit Account Name: Davis Munck P.C.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☑ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent	50	25
Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent	200	100
Multiple dependent claims	360	180

Total Claims ______ - 20 or HP = ______ x ______ = ______ (Extra Claims, Fee ($), Fee Paid ($))

HP = highest number of total claims paid for, if greater than 20

Indep. Claims ______ - 3 or HP = ______ x ______ = ______ (Extra Claims, Fee ($), Fee Paid ($))

HP = highest number of independent claims paid for, if greater than 3

Multiple Dependent Claims — Fee ($) ______ Fee Paid ($) ______

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ______ - 100 = Extra Sheets ______ / 50 = Number of each additional 50 or fraction thereof ______ (round up to a whole number) x Fee ($) ______ = Fee Paid ($) ______

4. OTHER FEE(S) Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount) ______

Other: Appeal Brief filing fee $500.00

SUBMITTED BY

Signature	John T. Mockler	Registration No. (Attorney/Agent) 39,775	Telephone 972-628-3600
Name (Print/Type)	John T. Mockler		Date 10 Feb. 2006

DOCKET NO. 2002.01.005.WS0
Client No. (SAMS01-00168)

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Purva R. Rajkotia
U.S. Serial No.:	10/028,571
Filed:	December 20, 2001
For:	SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK
Group No.:	2687
Examiner:	Eliseo Ramos-Feliciano

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

Applicants herewith respectfully submit that the Examiner's decision of July 12, 2005, finally rejecting Claims 31-60 in the present application, should be reversed, in view of the following arguments and authorities. This Brief is submitted on behalf of Appellant for the application identified above. A check is enclosed for the fee for filing a Brief on Appeal. Please charge any additional necessary fees to Deposit Account No. 50-0208.

TABLE OF CONTENTS

APPENDIX A - Claims Appendix

APPENDIX B - Copy of Formal Drawings

APPENDIX C - Copy of Patent Application 10/028,571 As Originally Filed

APPENDIX D - Evidence Appendix. There is no additional evidence in this appendix.

APPENDIX E - Related Proceedings Appendix - There are no related proceedings.

TABLE OF AUTHORITIES

Real Party in Interest

The real party in interest, and assignee of this case, is Samsung Electronics Co., Ltd.

Related Appeals or Interferences

To the best knowledge and belief of the undersigned attorney, there are none.

Status of Claims

Claims 31-60 are under final rejection, and are each appealed. The claims as currently written are included in the Claims Appendix (Appendix A).

Status of Amendments after Final

No amendments to the claims were entered after final rejection.

SUMMARY OF CLAIMED SUBJECT MATTER

The following summary refers to disclosed embodiments and their advantages, but does not delimit any of the claimed inventions.

In General

The present application is directed, in general, to a system and method for locating a mobile station (*A*) in a wireless network (**500**). A distance unit (**260**), associated with a base station (**510**), utilizes a random backoff parameter of the mobile station to determine distance between the base station and the mobile station. The distance unit determines a one way travel time of a range signal from the base station to the mobile station, and multiplies the one way travel time by the speed of light in order to obtain the distance from the base station to the mobile station. The one way travel time is obtained from one half the value of a quantity that is equal to a two way travel time of a range signal minus a time value of a random backoff parameter of the mobile station (***Eq. 1***). *Abstract;*

page 17, line 4 - page 18, line 15; page 19, line 13 - page 21, line 16; page 26, line 7 - page 29, line 8; Figures 5 and 6.

Support for Independent Claims

Note that, per 37 CFR §41.37, only each of the independent claims are discussed in this section. In the arguments below, however, the dependent claims are also discussed and distinguished from the prior art. The discussion of the claims is for illustrative purposes, and is not intended to effect the scope of the claims.

Independent Claim 31

Independent Claim 31 describes an apparatus for determining a distance from a base station to a mobile station, for use in a wireless network communications system comprising a plurality of base stations and a plurality of mobile stations. *Page 5, line 4 - page 6, line 17; page 11, line 11 - page 12, line 5; page 26, line 7 - page 28, line 4; Figure 4; Figure 5.*

The apparatus comprises a distance unit, associated with the base station. *Page 15, line 12 - page 17, line 5; page 24, lines 11 - 13; page 26, lines 7 - 18; Figure 2; Figure 4; Figure 5.*

The distance unit is capable of: obtaining a two way travel time - which is a time of travel for a range signal to travel from the base station to the mobile station, and to travel from the mobile station to the base station; adjusting a value of the two way travel time, to correct for signal conditions causing a time difference in the arrival of the range signal at the base station; determining a one way travel time D from

$$D = \frac{1}{2}\,[(\textit{adjusted two way travel time}) - (\textit{random backoff})],$$

wherein said random backoff is a time value of a chip length of a random backoff parameter of the mobile station; and multiplying the one way travel time D by the speed of light to obtain the distance from the base station to the mobile station. *Page 17, line 4 - page 21, line 16; page 28, line 5 - page 29, line 8; Figure 2; Figure 6.*

Independent Claim 38

Independent Claim 38 describes a wireless network communications system, comprising a base station and a mobile station, the base station having an apparatus for determining a distance from the base station to the mobile station. *Page 5, line 4 - page 6, line 17; page 11, line 11 - page 12, line 5; page 26, line 7 - page 28, line 4; Figure 4; Figure 5.*

The apparatus comprises a distance unit, associated with the base station. *Page 15, line 12 - page 17, line 5; page 24, lines 11 - 13; page 26, lines 7 - 18; Figure 2; Figure 4; Figure 5.*

The distance unit is capable of: obtaining a two way travel time - which is a time of travel for a range signal to travel from the base station to the mobile station, and to travel from the mobile station to the base station; adjusting a value of the two way travel time, to correct for signal conditions causing a time difference in the arrival of the range signal at the base station; determining a one way travel time D from

D = ½ [(adjusted two way travel time) - (random backoff)],

wherein said random backoff is a time value of a chip length of a random backoff parameter of the mobile station; and multiplying the one way travel time D by the speed of light to obtain the distance from the base station to the mobile station. *Page 17, line 4 - page 21, line 16; page 28, line 5 - page 29, line 8; Figure 2; Figure 6.*

Independent Claim 45

Independent Claim 45 describes - for use in a wireless network communications system comprising a base station and a mobile station - a method of determining a distance from the base station to the mobile station. *Page 5, line 4 - page 6, line 17; page 11, line 11 - page 12, line 5; page 26, line 7 - page 28, line 4; Figure 4; Figure 5.*

A distance unit, associated with the base station, obtains a two way travel time - which is a time of travel for a range signal to travel from the base station to the mobile station, and to travel from the mobile station to the base station. *Page 15, line 12 - page 17, line 14; page 28, lines 12 - 20; Figure 2; Figure 6.*

The value of the two way travel time is adjusted to correct for signal conditions causing a time difference in the arrival of the range signal at the base station; a one way travel time D is determined from

$$D = \tfrac{1}{2}\,[(\textit{adjusted two way travel time}) - (\textit{random backoff})],$$

wherein said random backoff is a time value of a chip length of a random backoff parameter of the mobile station; and the one way travel time D is multiplied by the speed of light to obtain the distance from the base station to the mobile station. *Page 15, line 12 - page 21, line 16; page 24, lines 11 - 13; page 26, lines 7 - 18; page 28, line 5 - page 29, line 8; Figure 2; Figures 4 - 6.*

Independent Claim 53

Independent Claim 53 describes - for use in a wireless network communications system comprising a plurality of base stations and a plurality of mobile stations - a method of locating a mobile station in a area between three base stations. *Page 5, line 4 - page 6, line 17; page 11, line 11 - page 12, line 5; page 24, line 11 - page 28, line 4; Figure 4; Figure 5.*

A distance unit, associated with each base station, obtains a two way travel time - which is a time of travel for a range signal to travel from each respective base station to the mobile station, and to travel from the mobile station to each respective base station. *Page 15, line 12 - page 17, line 14; page 28, lines 12 - 20; Figure 2; Figure 6.*

The value of each respective two way travel time is adjusted to correct for signal conditions causing a time difference in the arrival of the range signal at each respective base station; a one way travel time D from each respective base station to the mobile station is calculated as

$$D = \tfrac{1}{2}\,[(\textit{adjusted two way travel time}) - (\textit{random backoff})],$$

wherein said random backoff is a time value of a chip length of a random backoff parameter of the mobile station; and each one way travel time D is multiplied by the speed of light to obtain the distance from each respective base station to the mobile station. *Page 15, line 12 - page 21, line 16; page 24, lines 11 - 13; page 26, lines 7 - 18; page 28, line 5 - page 29, line 8; Figure 2; Figures 4 - 6.*

A location of the mobile station within the area between the three base stations is identified using the respective distances of the mobile station from the three base stations. *Page 24, line 11 - page 28, line 4; Figures 4 and 5.*

Independent Claim 56

Independent Claim 56 describes an apparatus for locating a mobile station in an area between three base stations, for use in a wireless network communications system comprising a plurality of base stations and a plurality of mobile stations. *Page 5, line 4 - page 6, line 17; page 11, line 11 - page 12, line 5; page 24, line 11 - page 28, line 4; Figure 4; Figure 5.*

The apparatus comprises a distance unit, associated with each of the three base stations. *Page 15, line 12 - page 17, line 5; page 24, lines 11 - 13; page 26, lines 7 - 18; Figure 2; Figure 4; Figure 5.*

The distance unit is capable of: obtaining a two way travel time - which is a time of travel for a range signal to travel from each respective base station to the mobile station, and to travel from the mobile station to each respective base station; adjusting a value of each respective two way travel time, to correct for signal conditions causing a time difference in the arrival of each range signal at each respective base station; determining a one way travel time D from each respective base station to the mobile station by

$$D = \tfrac{1}{2}\,[(\textit{adjusted two way travel time}) - (\textit{random backoff})],$$

wherein said random backoff is a time value of a chip length of a random backoff parameter of the mobile station; and multiplying each respective one way travel time D by the speed of light to obtain the distance from each respective base station to the mobile station. *Page 15, line 12 - page 21, line 16; page 24, lines 11 - 13; page 26, lines 7 - 18; page 28, line 5 - page 29, line 8; Figure 2; Figures 4 - 6.*

A location of the mobile station within the area between the three base stations is identified using the respective distances of the mobile station from the three base stations. *Page 24, line 11 - page 28, line 4; Figures 4 and 5.*

Grounds of Rejection to be Reviewed on Appeal

1. Are Claims 31-60 obvious over U.S. Patent No. 6,061,565 to Innes, *et al.*("Innes") in view of the Admitted Prior Art, and further in view of U.S. Patent No. 6,489,923 to Bevan, *et al.*, ("Bevan")?

ARGUMENT

Stated Grounds of Rejection

The rejections outstanding against the Claims are as follows:

In Sections 1 and 2 of the July 12, 2005, Office Action, the Examiner rejected Claims 31-60 under 35 U.S.C. §103(a) as being unpatentable over the United States Patent No. 6,061,565 to Innes, *et al.* (hereafter, simply "Innes") in view of the Admitted Prior Art in further view of United States Patent No. 6,489,923 to Bevan *et al.* (hereafter, simply "Bevan").

Legal Standards

The legal standards for an obviousness[1] rejection are referenced in the footnotes below.

Analysis of Examiner's Rejection

The cited references are each briefly discussed in relevant part, and then the rejection of each claim is addressed separately under each ground of rejection.

---

[1] The Supreme Court has explained how to apply §103:

> Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined.
>
> *Graham v. John Deere Co.*, 383 U.S. 1, 148 U.S.P.Q. 459, 467 (1966).

Obviousness cannot be inferred from a combination of references without a showing that one of ordinary skill would have been motivated to combine those references:

> When prior art references require selective combination ... to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself.... Something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination.
>
> *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 5 U.S.P.Q.2d 1434, 1438 (Fed.Cir. 1988), *quoting Interconnect Planning Corp. v. Feil*, 227 U.S.P.Q. 543 (Fed.Cir. 1985), *and Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick*, 221 U.S.P.Q. 481 (Fed.Cir. 1984).

> Where an obviousness rejection is based on a combination of references, the Examiner must show that one of ordinary skill would have been motivated to combine those references.
>
> *See In re Nilssen*, 7 USPQ2d 1500 (Fed.Cir. 1988); *Panduit Corp. v. Dennison Mfg. Co.*, 1 USPQ2d 1593, 1597 (Fed.Cir. 1987); *ACS Hospital Systems v. Montefiore Hospital*, 220 USPQ 929 (Fed.Cir. 1984).
>
> While *[a reference]* may be capable of being modified to run the way *[the applicant's]* apparatus is claimed, there must be a suggestion or motivation in the reference to do so. See In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984) ("The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification.").
>
> *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed.Cir. 1990).

Innes is drawn to a position location system for locating a mobile station in a mobile radio system by: calculating a first distance between the mobile station and a first base station of the mobile radio system; calculating a second distance between the mobile station and a first base station of the mobile radio system; and calculating the position of the mobile station using the first and second calculated distances and known positions of the first and second base stations (i.e., triangulation). Properties of signal transmissions - i.e., signal delays - between the mobile station and the first and second base stations are used to determine the approximate distance between the mobile station and each respective base station. Position location can be carried out at any time when the mobile station is within range of at least two base stations. As such, Innes does have some functional similarities to the present application. However, Innes does not include a number of claimed elements and functions, as described in detail below, and does not provide suggestion or motivation to spontaneously and speculatively prompt the creation or addition of those elements or functions.

The **"Admitted Prior Art"** refers to the disclosure in Applicants' original application that the "randombackoff" parameter used in Equation 1 is specified in the IS-95 Code Division Multiple Access (CDMA) standard for CDMA networks (the "Standard"). As specified in the Standard, the random backoff parameter is calculated from the equation:

$$\text{Random Backoff} = 2^{\text{PNRAN}} - 1;$$

where PNRAN is a pseudo noise random number having a value from zero (0) to nine (9). When PNRAN equals zero (0), the random backoff parameter equals zero (0). When PNRAN equals nine (9), the random backoff parameter equals five hundred eleven (511). The random backoff parameter of a mobile station represents the time offset after which that mobile station starts a transmission. The random backoff parameter of a mobile station is proportional to the distance of that mobile station from a base station. A mobile station continually informs a base station of the current value of the random backoff parameter for that mobile station.

Bevan is drawn to a position location system for estimating, with respect to a base station or cellsite, the direction and range of a mobile station. The system estimates a bearing angle from a base station or cellsite to a mobile station using a direction finding antenna coupled to a receiver circuit located at the base station or cell site. Also disclosed are methods and apparatus for calibrating the direction finding antenna and the receiver circuit. While Bevan shares some functional similarities with the present application, it does not include a number of claimed elements and functions, as described in detail below.

Ground of Rejection 1: Claims 31-60 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,061,565 to Innes, *et al.*("Innes") in view of the Admitted Prior Art, and further in view of U.S. Patent No. 6,489,923 to Bevan, *et al.*, ("Bevan").

These claims are allowable over this combination of references, as discussed below.

Claim 31

Claim 31 requires, among other limitations, a base station distance unit capable of obtaining a two way travel time - a time of travel for a range signal to travel from a base station to a mobile station and to travel from the mobile station to the base station. The distance unit adjusts a value of the two way travel time to correct for signal conditions causing a time difference in arrival of the range signal at the base station. The distance unit determines a one way travel time *D* by subtracting a random backoff parameter from the adjusted two way travel time, and dividing that result by 2. The distance unit multiplies the one way travel time *D* by the speed of light to obtain the distance between the base station and mobile station.

Applicants respectfully submit that - absent a highly selective and speculative hindsight reconstruction - the cited references do not to teach or suggest, alone or in proper combination, a base station distance unit having all the required elements of Claim 31.

The Examiner suggests "MMSU 36 and/or PLC 38" suffices as the distance unit required by Claim 31. Applicants respectfully traverse the Examiner's interpretation of Innes.

Applicants find that Innes discloses one or more message monitoring and substitution units (MMSUs) 36, placed in the Abis interface 28 between each BTS 26 and its BSC 24. *Col. 4, lines 45-47; Fig. 4.* Innes discloses a separate position location controller ("PLC") 38 that controls the MMSUs 36. *Col. 4, lines 47-48; Fig. 4.* The PLC 38 and MMSUs 36 may be integrated with, <u>or separate from</u>, the base transceiver station (BTS) 26 and base station controller (BSC) 24 components. *Col. 4, lines 48-50; Fig. 4.*

Importantly, the MMSUs 36 <u>collect the distance information from the BTSs 26</u> and supply it (i.e., the distance information) to the PLC 38, where it is processed in order to determine location of each mobile station under analysis. *Col. 4, lines 60-63.* Applicants respectfully submit that this clearly indicates that distance estimation or calculation is not made by either the MMSUs 36 or the PLC 38.

Thus, neither MMSU 36 or PLC 38, alone or in combination, provide the distance unit required by Claim 31.

Moreover, Applicants cannot find, and the Examiner has not cited, any other teaching or suggestion within Innes of a distance unit as required by Claim 31. Applicants only find that the determination or calculation of distance is referenced generally in relation to BTS 26. *Col. 3, line 38 - Col. 4, line 37.*

Applicants respectfully submit that Innes fails to disclose or suggest <u>a</u> distance unit as required by Claim 31.

This deficiency of Innes notwithstanding, the Examiner goes on to suggest that Innes discloses "obtaining a two way travel (sic), wherein the two way travel time is a time of travel for a range signal to travel from the base station to the mobile station and to travel from the mobile station to the base station" and "determining a one way travel time ... of a signal from said base station to said mobile station."

However, Claim 31 requires that a distance unit: adjusts a value of the two way travel time to correct for signal conditions causing a time difference in arrival of the range signal at the base station; and determines a one way travel time *D* by subtracting a random backoff parameter from the adjusted two way travel time, and dividing that result by 2.

With respect to these requirements of Claim 31, the Examiner has conceded the deficiencies of Innes, and the combination of Innes with the Admitted Prior Art - "Innes et al. fails to specifically disclose that the delay (σ) is a random backoff ... as defined by applicant."; "Innes et al. and the Admitted Prior Art fail to specifically disclose that the distance unit is capable of adjusting a value of the travel time to correct for signal conditions causing a time difference in arrival of the range signal at the base station, as claimed."

Applicants agree that "Innes et al. fails to specifically disclose that the delay (σ) is a random backoff ... as defined by applicant."

Applicants find that Innes discloses a known fixed delay of period (σ), which is equivalent to 1.73076 ms. *Col. 4, lines 6 - 8.*

In an attempt to remedy this deficiency of Innes, the Examiner suggests that "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to replace Innes et al.'s GSM delay σ by IS-95 CDMA standard's random backoff parameter", claiming that "Following Innes et al.'s suggestion of applying their invention to a CDMA cellular mobile radio system, such as IS-95 CDMA, one of ordinary skill in the art would easily recognize that Innes et al.'s delay σ would be the counterpart of IS-95 CDMA standard's random backoff parameter."

Applicants respectfully traverse the Examiner's interpretation of Innes, and conclusory remarks concerning motivation or suggestion found in Innes.

Applicants find that Innes discloses that its invention is also applicable to other types of cellular mobile radio systems, including CDMA and TDMA. *Col. 5, lines 65 - 67.* With respect to CDMA, Innes briefly references a CDMA "soft hand-off" during which an MS is linked with two or more BTSs. *Col. 6, lines 3-7.* Innes then teaches that "Position location can therefore

advantageously take place when the MS is in communication with two or more BTSs at the time of such a soft hand-off." *Col. 6, lines 7-10.*

Innes does not specifically reference IS-95 CDMA. Innes does not teach or suggest any modification of its methods or calculations to utilize alternative parameters as defined by a CDMA standard; much less utilize alternative parameters as defined by the IS-95 CDMA standard; still much less utilize only a single, <u>random</u> parameter defined by the IS-95 CDMA standard as a replacement for its known <u>fixed</u> delay of period (σ).

Applicants respectfully submit that, in order to selectively combine a single parameter of the Admitted Prior Art with the teachings of Innes, one of ordinary skill in the art would have to: 1) find, read and understand Innes' disclosure of a position location system, described extensively in reference to a GSM-based network; 2) read Innes' general suggestion that its invention may be applied to a CDMA type of system, and decide to apply to such a system; 3) read Innes' brief suggestion that its position location may advantageously take place during a CDMA "soft hand-off"; 4) spontaneously decided or assume that, despite no teaching or suggestion of modifying its position location scheme, Innes' system nevertheless needs to be modified to perform its position location during a CDMA "soft hand-off"; 5) spontaneously decide or assume that <u>only a single element</u> of Innes' distance calculation scheme - a known <u>fixed</u> delay of period (σ) - needs to be modified; 6) decide upon or find the IS-95 CDMA standard; 7) selectively cull from the IS-95 CDMA standard only the random backoff parameter; 8) disregard Innes' teaching of a known <u>fixed</u> delay of period (σ), and its calculation assumptions based upon that known fixed period; 9) replace Innes' known <u>fixed</u> delay of period (σ) with IS-95's <u>random</u> backoff parameter; and 10) modify Innes' system, assumptions and calculations to generate a random backoff parameter and calculate distance using that random backoff parameter.

Applicants respectfully submit that Innes provides no teaching or motivation sufficient to motivate one of ordinary skill in the art to undertake such a highly selective and speculative process.

Moreover, even if one of ordinary skill did undertake such a selective modification process, and it was - somehow - successful, the resulting combination of Innes and the Admitted Prior Art

still "fail(s) to specifically disclose that the distance unit is capable of adjusting a value of the travel time to correct for signal conditions causing a time difference in arrival of the range signal at the base station," as conceded by the Examiner.

Despite the fact that Innes appears to contain no teaching or suggestion of why to adjust a two-way travel time, or how to do it, the Examiner nevertheless spontaneously turns to Bevan to selectively cull from it only its "method and apparatus for adjusting a value of travel time to correct for signal conditions causing a time difference in arrival of the range signal at the base station" - alleging that "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to adjust the value of the two way travel time to correct for signal conditions causing a time difference in the arrival of the range signal at the base station, in order to achieve accurate and precise positioning of mobile wireless receivers ... as suggested by Bevan et al."

Applicants respectfully disagree with the Examiner's suggested reconstruction. Applicant further submits that the Examiner improperly relies upon Bevan for the motivation to combine when - in the absence of suggestion or motivation to combine in Innes - one of ordinary skill in the art would not even be prompted to look for Bevan.

Applicants find that Bevan discloses a system in which the position of a mobile station with respect to a base station is evaluated using direction finding (DF) techniques to determine the bearing or direction of the mobile station, and round trip delay (RTD) techniques to determine the range or distance of the mobile station from the base station. *Col. 3, lines 52-57.*

Bevan determines the bearing of the mobile station relative to the base station by determining the direction from which the mobile station's signal is received. *Col. 3, line 62 - Col. 4, line 21; Fig. 1.* Bevan discloses a DF processor architecture for mathematically processing signals received at a direction finding antenna. *Col. 6, line 28 - Col. 7, line 35; Fig. 3.* Bevan notes that with any radio-based direction-finding system, there are several mechanisms for potential errors in attempting to estimate the angle of arrival (i.e., bearing or direction) and range (i.e., distance) of received signal sources. *Col. 1, lines 40 -43.* Bevan goes on to list a general reference to error mechanisms in

measuring signal round-trip delay (RTD), in distinction and addition to: noise/interference, multipath (angle and delay spread), Doppler, and calibration errors. *Col. 1, lines 44 - 50.*

The remainder of Bevan extensively addresses Doppler errors and calibration errors in the direction finding (DF) process. *Col. 6, lines 17 - 28.*

Other than a brief acknowledgment of their existence in Col. 1, Bevan does not address "error mechanisms in measuring signal round-trip delay (RTD)." Bevan does not disclose or suggest adjusting the value of a two way travel time.

Thus, in order to selectively combine Innes, the Admitted Prior Art, and Bevan as the Examiner has suggested, one of ordinary skill in the art would have to: 1) spontaneously decide or assume that - despite the fact that Innes fails to teach or suggest the adjustment of a two-way travel time - the highly selective combination of Innes and the Admitted Prior Art nevertheless needs to adjust its two-way travel time; 2) seek out and find the Bevan reference; 3) disregard Bevan's extensive teaching on overcoming Doppler effect and calibration errors in <u>direction finding</u> (DF) processes; 4) focus solely on a single, general reference in Bevan to "error mechanisms in measuring signal round-trip delay (RTD)"; and 5) spontaneously created and modify structures, methods and operations of the Innes system to add functionality to adjust a value of a two way travel time to correct for signal conditions causing a time difference in arrival of a range signal at a base station.

Applicants respectfully submit that, without the benefit of hindsight reconstruction, Innes provides no teaching or motivation sufficient to motivate one of ordinary skill in the art to undertake a second such highly selective and speculative process.

Even if one of ordinary skill did undertake two such spontaneous and selective modification processes, and they were - somehow - successful, the resulting combination of Innes, the Admitted Prior Art, and Bevan still fails to provide all of the elements required by Claim 31.

Applicants submit that claim 31 overcomes the Examiner's rejection and is allowable. Applicants therefore respectfully request allowance of claim 31 and reversal of the Examiner's rejection.

Claim 32

Claim 32 depends from allowable claim 31, so the arguments above with respect to claim 31 apply here, and these arguments are incorporated herein by reference.

Claim 32 further requires "wherein said distance unit is capable of adjusting said value of said two way travel time to correct a time difference of a multipath signal."

Applicants respectfully traverse the Examiner's claim that "Innes teaches that the distance unit is capable of adjusting the value of the two-way travel time to correct a time difference of a multipath or a Doppler shifted signal." Applicants find no such disclosure in Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 32 and reversal of the Examiner's rejections.

Claim 33

Claim 33 depends from allowable claim 31, so the arguments above with respect to claim 31 apply here, and these arguments are incorporated herein by reference.

Claim 33 further requires "wherein said distance unit is capable of adjusting said value of said two way travel time to correct a time difference of a Doppler shifted signal."

Applicants respectfully traverse the Examiner's claim that "Innes teaches that the distance unit is capable of adjusting the value of the two-way travel time to correct a time difference of a multipath or a Doppler shifted signal." Applicants find no such disclosure in Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 33 and reversal of the Examiner's rejections.

Claim 34

Claim 34 depends from allowable claim 31, so the arguments above with respect to claim 31 apply here, and these arguments are incorporated herein by reference.

Claim 34 further requires "wherein said distance unit is capable of obtaining said two way travel time by subtracting an arrival time of said range signal at said base station from said mobile station from a transmission time of said range signal from said base station to said mobile station."

Applicants respectfully traverse the Examiner's contentions regarding the disclosure of Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 34 and reversal of the Examiner's rejections.

Claim 35

Claim 35 depends from allowable claim 31, so the arguments above with respect to claim 31 apply here, and these arguments are incorporated herein by reference.

Claim 35 further requires "wherein said random backoff parameter for said mobile station has a chip length value between zero chip lengths and five hundred eleven chip lengths."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 35 and reversal of the Examiner's rejections.

Claim 36

Claim 36 depends from allowable claim 35, so the arguments above with respect to claims 31 and 35 apply here, and these arguments are incorporated herein by reference.

Claim 36 further requires "wherein a time value for one chip length value is eight hundred thirteen and eight tenths nanoseconds."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 36 and reversal of the Examiner's rejections.

Claim 37

Claim 37 depends from allowable claim 31, so the arguments above with respect to claim 31 apply here, and these arguments are incorporated herein by reference.

Claim 37 further requires "wherein said distance unit is capable of obtaining a distance from said base station to said mobile station with a distance resolution of approximately two hundred forty four meters."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 37 and reversal of the Examiner's rejections.

Claim 38

The Examiner has rejected claim 38 under the same rationale as the rejection of claim 31.

Thus, the arguments above with respect to claim 31 apply here, and these arguments are incorporated herein by reference

Applicants respectfully request allowance of claim 38 and reversal of the Examiner's rejections.

Claim 39

Claim 39 depends from allowable claim 38, so the arguments above with respect to claim 38 apply here, and these arguments are incorporated herein by reference.

Claim 39 further requires "wherein said distance unit is capable of adjusting said value of said two way travel time to correct a time difference of a multipath signal."

Applicants respectfully traverse the Examiner's claim that "Innes teaches that the distance unit is capable of adjusting the value of the two-way travel time to correct a time difference of a multipath or a Doppler shifted signal." Applicants find no such disclosure in Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 39 and reversal of the Examiner's rejections.

Claim 40

Claim 40 depends from allowable claim 38, so the arguments above with respect to claim 38 apply here, and these arguments are incorporated herein by reference.

Claim 40 further requires "wherein said distance unit is capable of adjusting said value of said two way travel time to correct a time difference of a Doppler shifted signal."

Applicants respectfully traverse the Examiner's claim that "Innes teaches that the distance unit is capable of adjusting the value of the two-way travel time to correct a time difference of a multipath or a Doppler shifted signal." Applicants find no such disclosure in Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 40 and reversal of the Examiner's rejections.

<u>Claim 41</u>

Claim 41 depends from allowable claim 38, so the arguments above with respect to claim 38 apply here, and these arguments are incorporated herein by reference.

Claim 41 further requires "wherein said distance unit is capable of obtaining said two way travel time by subtracting an arrival time of said range signal at said base station from said mobile station from a transmission time of said range signal from said base station to said mobile station."

Applicants respectfully traverse the Examiner's contentions regarding the disclosure of Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 41 and reversal of the Examiner's rejections.

<u>Claim 42</u>

Claim 42 depends from allowable claim 38, so the arguments above with respect to claim 38 apply here, and these arguments are incorporated herein by reference.

Claim 42 further requires "wherein said random backoff parameter for said mobile station has a chip length value between zero chip lengths and five hundred eleven chip lengths."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 42 and reversal of the Examiner's rejections.

Claim 43

Claim 43 depends from allowable claim 42, so the arguments above with respect to claims 42 and 38 apply here, and these arguments are incorporated herein by reference.

Claim 43 further requires "wherein a time value for one chip length value is eight hundred thirteen and eight tenths nanoseconds."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 43 and reversal of the Examiner's rejections.

Claim 44

Claim 44 depends from allowable claim 38, so the arguments above with respect to claim 38 apply here, and these arguments are incorporated herein by reference.

Claim 44 further requires "wherein said distance unit is capable of obtaining a distance from said base station to said mobile station with a distance resolution of approximately two hundred forty four meters."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 44 and reversal of the Examiner's rejections.

Claim 45

The Examiner has rejected claim 45 under the same rationale as the rejection of claim 31.

Thus, the arguments above with respect to claim 31 apply here, and these arguments are incorporated herein by reference

Applicants respectfully request allowance of claim 45 and reversal of the Examiner's rejections.

Claim 46

Claim 46 depends from allowable claim 45, so the arguments above with respect to claim 45 apply here, and these arguments are incorporated herein by reference.

Claim 46 further requires "wherein the step of adjusting the value of the two way travel time adjusts the two way travel time to correct a time difference of a multipath signal."

Applicants respectfully traverse the Examiner's claim that "Innes teaches that the distance unit is capable of adjusting the value of the two-way travel time to correct a time difference of a multipath or a Doppler shifted signal." Applicants find no such disclosure in Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 46 and reversal of the Examiner's rejections.

Claim 47

Claim 47 depends from allowable claim 45, so the arguments above with respect to claim 45 apply here, and these arguments are incorporated herein by reference.

Claim 47 further requires "wherein the step of adjusting the value of the two way travel time adjusts the two way travel time to correct a time difference of a Doppler shifted signal."

Applicants respectfully traverse the Examiner's claim that "Innes teaches that the distance unit is capable of adjusting the value of the two-way travel time to correct a time difference of a multipath or a Doppler shifted signal." Applicants find no such disclosure in Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 47 and reversal of the Examiner's rejections.

Claim 48

Claim 48 depends from allowable claim 45, so the arguments above with respect to claim 45 apply here, and these arguments are incorporated herein by reference.

Claim 48 further requires "wherein the step of obtaining a two way travel time obtains the two way travel time by subtracting an arrival time of the range signal at the base station from the mobile station from a transmission time of the range signal from the base station to the mobile station."

Applicants respectfully traverse the Examiner's contentions regarding the disclosure of Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 48 and reversal of the Examiner's rejections.

Claim 49

Claim 49 depends from allowable claim 45, so the arguments above with respect to claim 45 apply here, and these arguments are incorporated herein by reference.

Claim 49 further requires "wherein the random backoff parameter for said mobile station has a chip length value between zero chip lengths and five hundred eleven chip lengths."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 49 and reversal of the Examiner's rejections.

Claim 50

Claim 50 depends from allowable claim 49, so the arguments above with respect to claims 49 and 45 apply here, and these arguments are incorporated herein by reference.

Claim 50 further requires "wherein a time value for one chip length value is eight hundred thirteen and eight tenths nanoseconds."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 50 and reversal of the Examiner's rejections.

Claim 51

Claim 51 depends from allowable claim 45, so the arguments above with respect to claim 45 apply here, and these arguments are incorporated herein by reference.

Claim 51 further requires "obtaining with the distance unit a distance from the base station to the mobile station with a distance resolution of approximately two hundred forty four meters."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 51 and reversal of the Examiner's rejections.

Claim 52

Claim 52 depends from claim 45, so the arguments above with respect to claim 45 apply here, and these arguments are incorporated herein by reference.

Claim 52 further requires "wherein the distance unit determines a distance from the base station to the mobile station in less than ten seconds."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of the speed thereof. The Examiner admits that Innes et al., the Admitted Prior Art, and Bevan et al. "fail to explicitly mention to determine the distance from the base station to the mobile station in less than ten seconds."

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 52 and reversal of the Examiner's rejections.

Claim 53

Claim 53 requires, among other limitations, a distance unit associated with each of three base stations, capable of obtaining a two way travel time - a time of travel for a range signal to travel from each respective base station to a mobile station and to travel from the mobile station to each respective base station. The value of each two way travel time is adjusted to correct for signal conditions causing a time difference in arrival of each range signal at the respective base station. A one way travel time *D* from each respective base station is calculated by subtracting a random backoff parameter from the adjusted two way travel time, and dividing that result by 2. Each respective one way travel time *D* is multiplied by the speed of light to obtain the distance between each respective base station and mobile station. The location of the mobile station within the area between the three base stations is identified using the respective distances between the mobile station and the three base stations.

Applicants respectfully submit that - absent a highly selective and speculative hindsight reconstruction - the cited references do not to teach or suggest, alone or in proper combination, a distance unit associated with each base station and all the required operational elements of Claim 53.

The Examiner suggests "MMSU 36 and/or PLC 38" suffices as the distance unit required by Claim 53. Applicants respectfully traverse the Examiner's interpretation of Innes.

Applicants find that Innes discloses one or more message monitoring and substitution units (MMSUs) 36, placed in the Abis interface 28 between each BTS 26 and its BSC 24. *Col. 4, lines 45-47; Fig. 4.* Innes discloses a separate position location controller ("PLC") 38 that controls the MMSUs 36. *Col. 4, lines 47-48; Fig. 4.* The PLC 38 and MMSUs 36 may be integrated with, <u>or separate from</u>, the base transceiver station (BTS) 26 and base station controller (BSC) 24 components. *Col. 4, lines 48-50; Fig. 4.*

Importantly, the MMSUs 36 <u>collect the distance information from the BTSs 26</u> and supply it (i.e., the distance information) to the PLC 38, where it is processed in order to determine location of each mobile station under analysis. *Col. 4, lines 60-63.* Applicants respectfully submit that this

clearly indicates that distance estimation or calculation is not made by either the MMSUs 36 or the PLC 38.

Thus, neither MMSU 36 or PLC 38, alone or in combination, provide the distance unit required by Claim 53.

Moreover, Applicants cannot find, and the Examiner has not cited, any other teaching or suggestion within Innes of a distance unit as required by Claim 53. Applicants only find that the determination or calculation of distance is referenced generally in relation to BTS 26. *Col. 3, line 38 - Col. 4, line 37.*

Applicants respectfully submit that Innes fails to disclose or suggest a distance unit associated with each base station as required by Claim 53.

This deficiency of Innes notwithstanding, the Examiner goes on to suggest that Innes discloses "obtaining a two way travel (sic), wherein the two way travel time is a time of travel for a range signal to travel from the base station to the mobile station and to travel from the mobile station to the base station" and "determining a one way travel time ... of a signal from said base station to said mobile station."

However, Claim 53 requires: adjusting a value of each respective two way travel time to correct for signal conditions causing a time difference in arrival of each range signal at the respective base station; and calculates a one way travel time *D* from each respective base station to the mobile station by subtracting a random backoff parameter from the adjusted two way travel time, and dividing that result by 2.

With respect to these requirements of Claim 53, the Examiner has conceded the deficiencies of Innes, and the combination of Innes with the Admitted Prior Art - "Innes et al. fails to specifically disclose that the delay (σ) is a random backoff ... as defined by applicant."; "Innes et al. and the Admitted Prior Art fail to specifically disclose that the distance unit is capable of adjusting a value of the travel time to correct for signal conditions causing a time difference in arrival of the range signal at the base station, as claimed."

Applicants agree that "Innes et al. fails to specifically disclose that the delay (σ) is a random backoff ... as defined by applicant."

Applicants find that Innes discloses a known fixed delay of period (σ), which is equivalent to 1.73076 ms. *Col. 4, lines 6 - 8.*

In an attempt to remedy this deficiency of Innes, the Examiner suggests that "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to replace Innes et al.'s GSM delay σ by IS-95 CDMA standard's random backoff parameter", claiming that "Following Innes et al.'s suggestion of applying their invention to a CDMA cellular mobile radio system, such as IS-95 CDMA, one of ordinary skill in the art would easily recognize that Innes et al.'s delay σ would be the counterpart of IS-95 CDMA standard's random backoff parameter."

Applicants respectfully traverse the Examiner's interpretation of Innes, and conclusory remarks concerning motivation or suggestion found in Innes.

Applicants find that Innes discloses that its invention is also applicable to other types of cellular mobile radio systems, including CDMA and TDMA. *Col. 5, lines 65 - 67.* With respect to CDMA, Innes briefly references a CDMA "soft hand-off" during which an MS is linked with two or more BTSs. *Col. 6, lines 3-7.* Innes then teaches that "Position location can therefore advantageously take place when the MS is in communication with two or more BTSs at the time of such a soft hand-off." *Col. 6, lines 7-10.*

Innes does not specifically reference IS-95 CDMA. Innes does not teach or suggest any modification of its methods or calculations to utilize alternative parameters as defined by a CDMA standard; much less utilize alternative parameters as defined by the IS-95 CDMA standard; still much less utilize only a single, random parameter defined by the IS-95 CDMA standard as a replacement for its known fixed delay of period (σ).

Applicants respectfully submit that, in order to selectively combine a single parameter of the Admitted Prior Art with the teachings of Innes, one of ordinary skill in the art would have to: 1) find, read and understand Innes' disclosure of a position location system, described extensively in reference to a GSM-based network; 2) read Innes' general suggestion that its invention may be

applied to a CDMA type of system, and decide to apply to such a system; 3) read Innes' brief suggestion that its position location may advantageously take place during a CDMA "soft hand-off"; 4) spontaneously decided or assume that, despite no teaching or suggestion of modifying its position location scheme, Innes' system nevertheless needs to be modified to perform its position location during a CDMA "soft hand-off"; 5) spontaneously decide or assume that <u>only a single element</u> of Innes' distance calculation scheme - a known <u>fixed</u> delay of period (σ) - needs to be modified; 6) decide upon or find the IS-95 CDMA standard; 7) selectively cull from the IS-95 CDMA standard only the random backoff parameter; 8) disregard Innes' teaching of a known <u>fixed</u> delay of period (σ), and its calculation assumptions based upon that known fixed period; 9) replace Innes' known <u>fixed</u> delay of period (σ) with IS-95's <u>random</u> backoff parameter; and 10) modify Innes' system, assumptions and calculations to generate a random backoff parameter and calculate distance using that random backoff parameter.

Applicants respectfully submit that Innes provides no teaching or motivation sufficient to motivate one of ordinary skill in the art to undertake such a highly selective and speculative process.

Moreover, even if one of ordinary skill did undertake such a selective modification process, and it was - somehow - successful, the resulting combination of Innes and the Admitted Prior Art still "fail(s) to specifically disclose that the distance unit is capable of adjusting a value of the travel time to correct for signal conditions causing a time difference in arrival of the range signal at the base station," as conceded by the Examiner.

Despite the fact that Innes appears to contain no teaching or suggestion of why to adjust a two-way travel time, or how to do it, the Examiner nevertheless spontaneously turns to Bevan to selectively cull from it only its "method and apparatus for adjusting a value of travel time to correct for signal conditions causing a time difference in arrival of the range signal at the base station" - alleging that "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to adjust the value of the two way travel time to correct for signal conditions causing a time difference in the arrival of the range signal at the base station, in order to achieve accurate and precise positioning of mobile wireless receivers ... as suggested by Bevan et al."

Applicants respectfully disagree with the Examiner's suggested reconstruction. Applicant further submits that the Examiner improperly relies upon Bevan for the motivation to combine when - in the absence of suggestion or motivation to combine in Innes - one of ordinary skill in the art would not even be prompted to look for Bevan.

Applicants find that Bevan discloses a system in which the position of a mobile station with respect to a base station is evaluated using direction finding (DF) techniques to determine the bearing or direction of the mobile station, and round trip delay (RTD) techniques to determine the range or distance of the mobile station from the base station. *Col. 3, lines 52-57.*

Bevan determines the bearing of the mobile station relative to the base station by determining the direction from which the mobile station's signal is received. *Col. 3, line 62 - Col. 4, line 21; Fig. 1.* Bevan discloses a DF processor architecture for mathematically processing signals received at a direction finding antenna. *Col. 6, line 28 - Col. 7, line 35; Fig. 3.* Bevan notes that with any radio-based direction-finding system, there are several mechanisms for potential errors in attempting to estimate the angle of arrival (i.e., bearing or direction) and range (i.e., distance) of received signal sources. *Col. 1, lines 40 -43.* Bevan goes on to list a general reference to error mechanisms in measuring signal round-trip delay (RTD), in distinction and addition to: noise/interference, multipath (angle and delay spread), Doppler, and calibration errors. *Col. 1, lines 44 - 50.*

The remainder of Bevan extensively addresses Doppler errors and calibration errors in the direction finding (DF) process. *Col. 6, lines 17 - 28.*

Other than a brief acknowledgment of their existence in Col. 1, Bevan does not address "error mechanisms in measuring signal round-trip delay (RTD)." Bevan does not disclose or suggest adjusting the value of a two way travel time.

Thus, in order to selectively combine Innes, the Admitted Prior Art, and Bevan as the Examiner has suggested, one of ordinary skill in the art would have to: 1) spontaneously decide or assume that - despite the fact that Innes fails to teach or suggest the adjustment of a two-way travel time - the highly selective combination of Innes and the Admitted Prior Art nevertheless needs to adjust its two-way travel time; 2) seek out and find the Bevan reference; 3) disregard Bevan's

extensive teaching on overcoming Doppler effect and calibration errors in direction finding (DF) processes; 4) focus solely on a single, general reference in Bevan to "error mechanisms in measuring signal round-trip delay (RTD)"; and 5) spontaneously created and modify structures, methods and operations of the Innes system to add functionality to adjust a value of a two way travel time to correct for signal conditions causing a time difference in arrival of a range signal at a base station.

Applicants respectfully submit that, without the benefit of hindsight reconstruction, Innes provides no teaching or motivation sufficient to motivate one of ordinary skill in the art to undertake a second such highly selective and speculative process.

Even if one of ordinary skill did undertake two such spontaneous and selective modification processes, and they were - somehow - successful, the resulting combination of Innes, the Admitted Prior Art, and Bevan still fails to provide all of the elements required by Claim 53.

Applicants submit that claim 53 overcomes the Examiner's rejection and is allowable. Applicants therefore respectfully request allowance of claim 53 and reversal of the Examiner's rejection.

Claim 54

Claim 54 depends from allowable claim 53, so the arguments above with respect to claim 54 apply here, and these arguments are incorporated herein by reference.

Claim 54 further requires "wherein the step of adjusting the value of each respective two way travel time adjusts each respective two way travel time to correct a time difference of a signal comprising one of a multipath signal and a Doppler shifted signal."

Applicants respectfully traverse the Examiner's claim that "Innes teaches that the distance unit is capable of adjusting the value of the two-way travel time to correct a time difference of a multipath or a Doppler shifted signal." Applicants find no such disclosure in Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 54 and reversal of the Examiner's rejections.

Claim 55

Claim 55 depends from allowable claim 53, so the arguments above with respect to claim 53 apply here, and these arguments are incorporated herein by reference.

Claim 55 further requires "wherein the step of identifying the location of the mobile station within the area between the three base stations comprises the steps of: providing the respective distances of said mobile station from the three base stations to a calculator unit not located within the three base stations; and calculating in said calculator unit a location of said mobile station from said respective distances of said mobile station from the three base stations."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Importantly, Applicants note that the Examiner contends that Innes discloses "a calculator unit (PLC 38) not located within the three base stations." This seems to directly contradict the Examiner's earlier assertion that equated PLC 38 with a distance unit associated with a base station.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 55 and reversal of the Examiner's rejections.

Claim 56

The Examiner has rejected claim 56 under the same rationale as the rejection of claim 53.

Thus, the arguments above with respect to claim 53 apply here, and these arguments are incorporated herein by reference

Applicants respectfully request allowance of claim 56 and reversal of the Examiner's rejections.

Claim 57

Claim 57 depends from allowable claim 56, so the arguments above with respect to claim 57 apply here, and these arguments are incorporated herein by reference.

Claim 57 further requires "wherein said distance unit is capable of adjusting said value of each respective two way travel time to correct a time difference of a signal comprising one of a multipath signal and a Doppler shifted signal."

Applicants respectfully traverse the Examiner's claim that "Innes teaches that the distance unit is capable of adjusting the value of the two-way travel time to correct a time difference of a multipath or a Doppler shifted signal." Applicants find no such disclosure in Innes.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 57 and reversal of the Examiner's rejections.

Claim 58

Claim 58 depends from allowable claim 56, so the arguments above with respect to claim 56 apply here, and these arguments are incorporated herein by reference.

Claim 58 further requires "wherein said location of said mobile station within said area between said three base stations has a distance resolution of approximately two hundred forty four meters."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes, the Admitted Prior Art, and Bevan, and the obviousness of selectively combining those references.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not to teach or suggest the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 58 and reversal of the Examiner's rejections.

Claim 59

Claim 59 depends from allowable claim 56, so the arguments above with respect to claim 56 apply here, and these arguments are incorporated herein by reference.

Claim 59 further requires "wherein said distance unit is capable of calculating a location of said mobile station from said respective distances of said mobile station from said three base stations."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes and the Admitted Prior Art, and the obviousness of selectively combining Innes and the Admitted Prior Art.

Importantly, Applicants note that the Examiner contends that Innes discloses "a calculator unit (PLC 38) not located within the three base stations." This seems to directly contradict the Examiner's earlier assertion that equated PLC 38 with a distance unit associated with a base station.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 59 and reversal of the Examiner's rejections.

Claim 60

Claim 60 depends from allowable claim 56, so the arguments above with respect to claim 56 apply here, and these arguments are incorporated herein by reference.

Claim 60 further requires "a calculator unit coupled to said three base stations but not located within said three base stations, said calculator unit capable of receiving from said three base stations

said respective distances of said mobile station from said three base stations; wherein said calculator unit is capable of calculating a location of said mobile station from said respective distances of said mobile station from said three base stations."

Applicants respectfully traverse the Examiner's contentions regarding the disclosures of Innes, the Admitted Prior Art, and Bevan, and the obviousness of selectively combining those references.

Importantly, Applicants note that the Examiner appears to contend that Innes discloses "a calculator unit (PLC 38) not located within the three base stations." This seems to directly contradict the Examiner's earlier assertion that equated PLC 38 with a distance unit associated with a base station.

Innes, the Admitted Prior Art, and Bevan, or any combination of them, do not appear to teach the elements as described with relation to all other elements of this and the parent claim.

Applicants respectfully request allowance of claim 60 and reversal of the Examiner's rejections.

Therefore, Claims 31-60 should be allowed over the cited combination Innes, the Admitted Prior Art, and Bevan, and the Examiner's obviousness rejections should be reversed.

Grouping of Claims

The claims on appeal do not stand or fall together, as may be seen from the arguments set forth above. Each claim has been argued separately under a separate subheading, and each claim should be considered separately. While the applicant recognizes that a formal statement regarding the grouping of claims is no longer required, each claim should be considered separately; or at the very least each claim which is argued separately in the preceding sections of this brief should be considered separately. Argument: The fact that the claims use different formulations (as detailed above) and/or have been argued separately, shows that, if their patentability is not considered separately, any adverse decision would show that the limitations of some claims had been unfairly ignored.

REQUESTED RELIEF

The Board is respectfully requested to reverse the outstanding rejections and return this application to the Examiner for allowance.

Respectfully submitted,
DAVIS MUNCK, P.C.

Date: 10 Feb. 2006

John T. Mockler

John T. Mockler
Registration No. 39,775

P.O. Drawer 800889
Dallas, Texas 75380
Phone: (972) 628-3600
Fax: (972) 628-3616
E-mail: wmunck@davismunck.com

Attorney for Applicant

DOCKET NO. 2002.01.005.WS0
Client No. (SAMS01-00168)

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Purva R. Rajkotia
U.S. Serial No.:	10/028,571
Filed:	December 20, 2001
For:	SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK
Group No.:	2687
Examiner:	Eliseo Ramos-Feliciano

APPENDIX A -

Claims Appendix

1-30. (Canceled).

31. (Previously Presented)

For use in wireless network communications system comprising a plurality of base stations and a plurality of mobile stations, an apparatus for determining a distance from a base station to a mobile station, said apparatus comprising:

a distance unit associated with said base station wherein said distance unit is capable of

obtaining a two way travel time, wherein said two way travel time is a time of travel for a range signal to travel from said base station to said mobile station and to travel from said mobile station to said base station,

adjusting a value of said two way travel time to correct for signal conditions causing a time difference in arrival of said range signal at said base station,

determining a one way travel time D from:

$$D = \tfrac{1}{2}\ [(adjusted\ two\ way\ travel\ time) - (random\ backoff)]$$

wherein said random backoff is a time value of a chip length of a random backoff parameter of said mobile station, and

multiplying said one way travel time D by the speed of light to obtain said distance from said base station to said mobile station.

32. (Previously Presented) The apparatus as set forth in Claim 31 wherein said distance unit is capable of adjusting said value of said two way travel time to correct a time difference of a multipath signal.

33. (Previously Presented) The apparatus as set forth in Claim 31 wherein said distance unit is capable of adjusting said value of said two way travel time to correct a time difference of a Doppler shifted signal.

34. (Previously Presented) The apparatus as set forth in Claim 31 wherein said distance unit is capable of obtaining said two way travel time by subtracting an arrival time of said range

signal at said base station from said mobile station from a transmission time of said range signal from said base station to said mobile station.

35. (Previously Presented) The apparatus as set forth in Claim 31 wherein said random backoff parameter for said mobile station has a chip length value between zero chip lengths and five hundred eleven chip lengths.

36. (Previously Presented) The apparatus as set forth in Claim 35 wherein a time value for one chip length value is eight hundred thirteen and eight tenths nanoseconds.

37. (Previously Presented) The apparatus as set forth in Claim 31 wherein said distance unit is capable of obtaining a distance from said base station to said mobile station with a distance resolution of approximately two hundred forty four meters.

38. (Previously Presented) A wireless network communications system comprising a base station and a mobile station, said base station comprising an apparatus for determining a distance from said base station to said mobile station, said apparatus comprising:

a distance unit associated with said base station wherein said distance unit is capable of

obtaining a two way travel time, wherein said two way travel time is a time of travel for a range signal to travel from said base station to said mobile station and to travel from said mobile station to said base station,

adjusting a value of said two way travel time to correct for signal conditions causing a time difference in arrival of said range signal at said base station,

determining a one way travel time D from:

$$D = \frac{1}{2}\,[(\textit{adjusted two way travel time}) - (\textit{random backoff})]$$

wherein said random backoff is a time value of a chip length of a random backoff parameter of said mobile station, and

multiplying said one way travel time D by the speed of light to obtain said distance from said base station to said mobile station.

39. (Previously Presented) The apparatus as set forth in Claim 38 wherein said distance unit is capable of adjusting said value of said two way travel time to correct a time difference of a multipath signal.

40. (Previously Presented) The apparatus as set forth in Claim 38 wherein said distance unit is capable of adjusting said value of said two way travel time to correct a time difference of a Doppler shifted signal.

41. (Previously Presented) The apparatus as set forth in Claim 38 wherein said distance unit is capable of obtaining said two way travel time by subtracting an arrival time of said range signal at said base station from said mobile station from a transmission time of said range signal from said base station to said mobile station.

42. (Previously Presented) The apparatus as set forth in Claim 38 wherein said random backoff parameter for said mobile station has a chip length value between zero chip lengths and five hundred eleven chip lengths.

43. (Previously Presented) The apparatus as set forth in Claim 42 wherein a time value for one chip length value is eight hundred thirteen and eight tenths nanoseconds.

44. (Previously Presented) The apparatus as set forth in Claim 38 wherein said distance unit is capable of obtaining a distance from said base station to said mobile station with a distance resolution of approximately two hundred forty four meters.

45. (Previously Presented) For use in wireless network communications system comprising a base station and a mobile station, a method of determining a distance from the base station to the mobile station comprising the steps of:

obtaining with a distance unit associated with the base station a two way travel time, wherein the two way travel time is a time of travel for a range signal to travel from the base station to the mobile station and to travel from the mobile station to the base station;

adjusting a value of the two way travel time to correct for signal conditions causing a time difference in arrival of the range signal at the base station;

calculating a one way travel time D from:

$D = \frac{1}{2}$ *[(adjusted two way travel time) - (random backoff)]*

wherein said random backoff is a time value of a chip length of a random backoff parameter of the mobile station; and

multiplying the one way travel time D by the speed of light to obtain the distance from the base station to the mobile station.

46. (Previously Presented) The method as set forth in Claim 45 wherein the step of adjusting the value of the two way travel time adjusts the two way travel time to correct a time difference of a multipath signal.

47. (Previously Presented) The method as set forth in Claim 45 wherein the step of adjusting the value of the two way travel time adjusts the two way travel time to correct a time difference of a Doppler shifted signal.

48. (Previously Presented) The method as set forth in Claim 45 wherein the step of obtaining a two way travel time obtains the two way travel time by subtracting an arrival time of the range signal at the base station from the mobile station from a transmission time of the range signal from the base station to the mobile station.

49. (Previously Presented) The method as set forth in Claim 45 wherein the random backoff parameter for the mobile station has a chip length value between zero chip lengths and five

hundred eleven chip lengths.

50. (Previously Presented) The method as set forth in Claim 45 wherein a time value for one chip length value is eight hundred thirteen and eight tenths nanoseconds.

51. (Previously Presented) The method as set forth in Claim 45 further comprising the step of:

obtaining with the distance unit a distance from the base station to the mobile station with a distance resolution of approximately two hundred forty four meters.

52. (Previously Presented) The method as set forth in Claim 45 wherein the distance unit determines a distance from the base station to the mobile station in less than ten seconds.

53. (Previously Presented) For use in wireless network communications system comprising a plurality of base stations and a plurality of mobile stations, a method for locating a mobile station in an area between three base stations, said method comprising the steps of:

obtaining with a distance unit associated with each of the three base stations a two way travel time, wherein the two way travel time is a time of travel for a range signal to travel from each respective base station to the mobile station and to travel from the mobile station to each respective base station;

adjusting a value of each respective two way travel time to correct for signal conditions

causing a time difference in arrival of each range signal at the respective base station;

calculating a one way travel time D from each respective base station to the mobile station where:

$$D = \frac{1}{2}\,[(\textit{adjusted two way travel time}) - (\textit{random backoff})]$$

wherein said random backoff is a time value of a chip length of a random backoff parameter of the mobile station;

multiplying each respective one way travel time D by the speed of light to obtain the distance from each respective base station to the mobile station; and

identifying a location of the mobile station within the area between the three base stations using the respective distances of the mobile station from the three base stations.

54. (Previously Presented) The method as set forth in Claim 53 wherein the step of adjusting the value of each respective two way travel time adjusts each respective two way travel time to correct a time difference of a signal comprising one of a multipath signal and a Doppler shifted signal.

55. (Previously Presented) The method as set forth in Claim 53 wherein the step of identifying the location of the mobile station within the area between the three base stations comprises the steps of:

providing the respective distances of said mobile station from the three base stations to a

calculator unit not located within the three base stations; and

calculating in said calculator unit a location of said mobile station from said respective distances of said mobile station from the three base stations.

56. (Previously Presented) For use in wireless network communications system comprising a plurality of base stations and a plurality of mobile stations, an apparatus for locating a mobile station in an area between three base stations, said apparatus comprising:

a distance unit associated with each of said three base stations wherein said distance unit is capable of

obtaining a two way travel time, wherein said two way travel time is a time of travel for a range signal to travel from each respective base station to said mobile station and to travel from said mobile station to each respective base station,

adjusting a value of each respective two way travel time to correct for signal conditions causing a time difference in arrival of each said range signal at each respective base station,

determining a one way travel time D from each respective base station to the mobile station where:

$$D = \tfrac{1}{2}\,[(\textit{adjusted two way travel time}) - (\textit{random backoff})]$$

wherein said random backoff is a time value of a chip length of a random backoff parameter of said mobile station,

multiplying each respective one way travel time D by the speed of light to obtain said distance from each respective base station to said mobile station, and

identifying a location of said mobile station within the area between said three base stations using said respective distances of said mobile station from said three base stations.

57. (Previously Presented) The apparatus as set forth in Claim 56 wherein said distance unit is capable of adjusting said value of each respective two way travel time to correct a time difference of a signal comprising one of a multipath signal and a Doppler shifted signal.

58. (Previously Presented) The apparatus as set forth in Claim 56 wherein said location of said mobile station within said area between said three base stations has a distance resolution of approximately two hundred forty four meters.

59. (Previously Presented) The apparatus as set forth in Claim 56 wherein said distance unit is capable of calculating a location of said mobile station from said respective distances of said mobile station from said three base stations.

60. (Previously Presented) The apparatus as set forth in Claim 56 further comprising:

a calculator unit coupled to said three base stations but not located within said three base stations, said calculator unit capable of receiving from said three base stations said respective distances of said mobile station from said three base stations;

wherein said calculator unit is capable of calculating a location of said mobile station from said respective distances of said mobile station from said three base stations.

DOCKET NO. 2002.01.005.WS0
Client No. (SAMS01-00168)

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Purva R. Rajkotia
U.S. Serial No.:	10/028,571
Filed:	December 20, 2001
For:	SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK
Group No.:	2687
Examiner:	Eliseo Ramos-Feliciano

APPENDIX B -
Copy of Formal Drawings

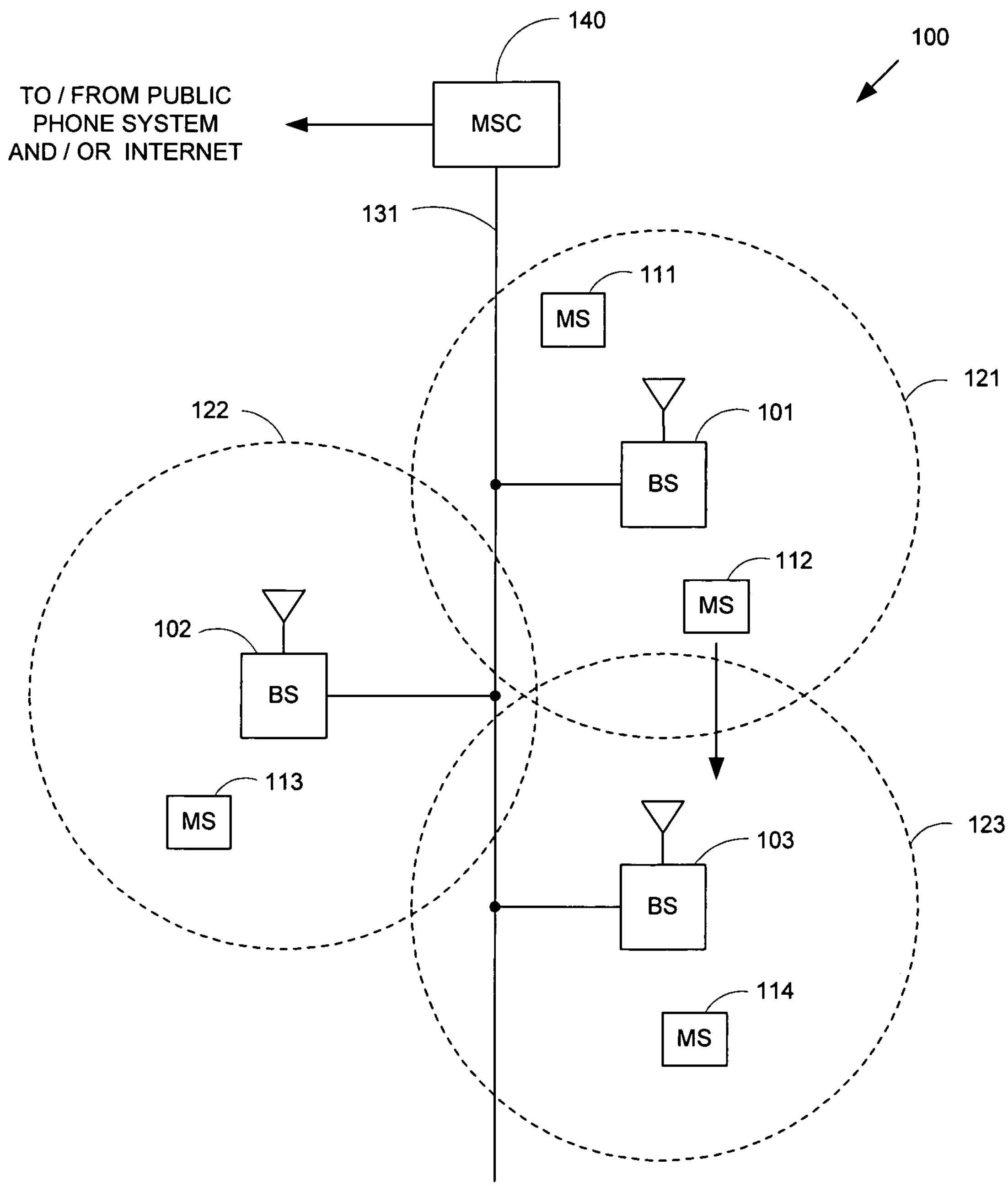

FIGURE 1
PRIOR ART

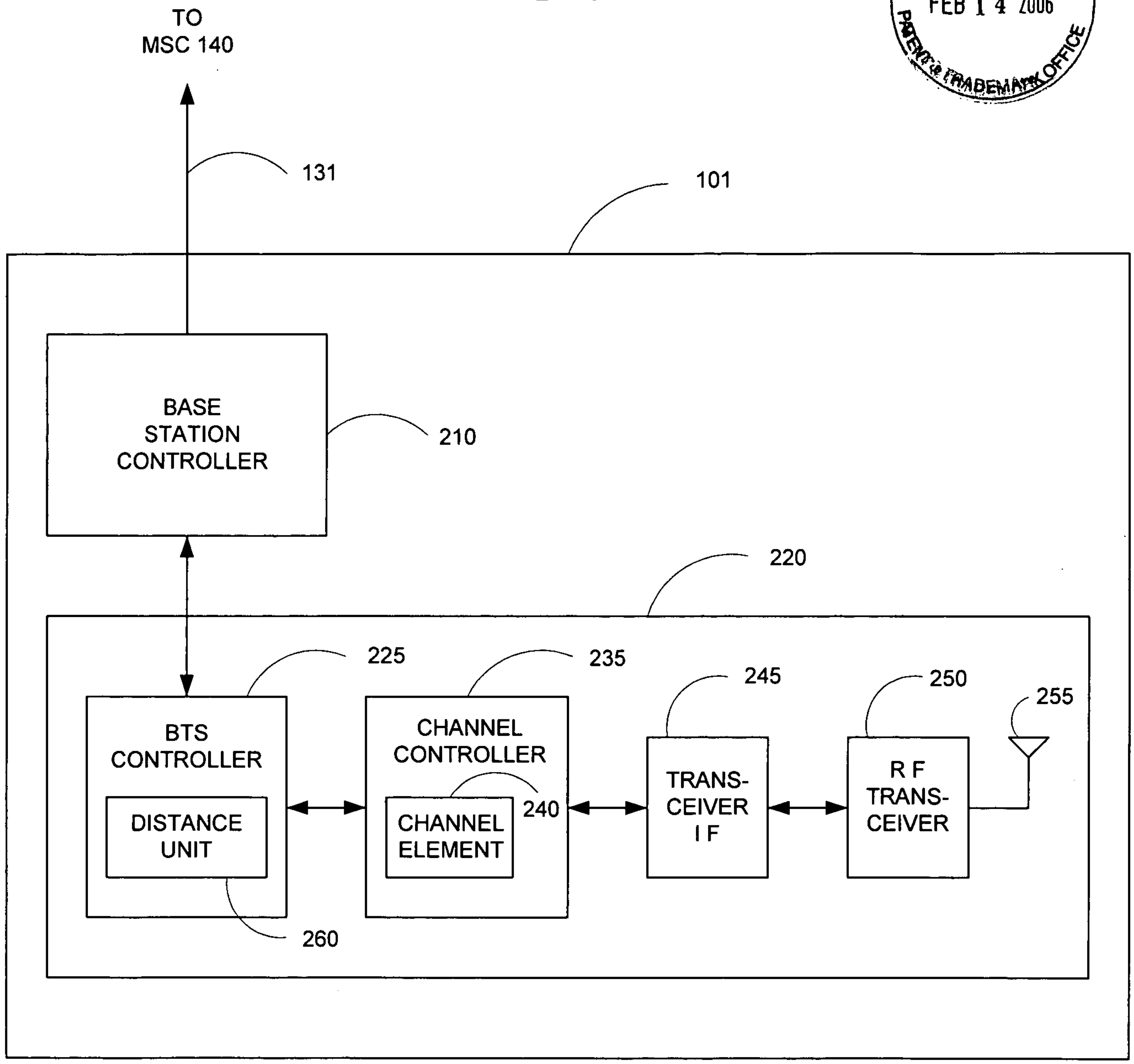
TO
MSC 140
131
101
BASE
STATION
CONTROLLER
210
220
225
235
245
250
255
BTS
CONTROLLER
DISTANCE
UNIT
CHANNEL
CONTROLLER
CHANNEL
ELEMENT
240
TRANS-
CEIVER
I F
R F
TRANS-
CEIVER
260

FIGURE 2

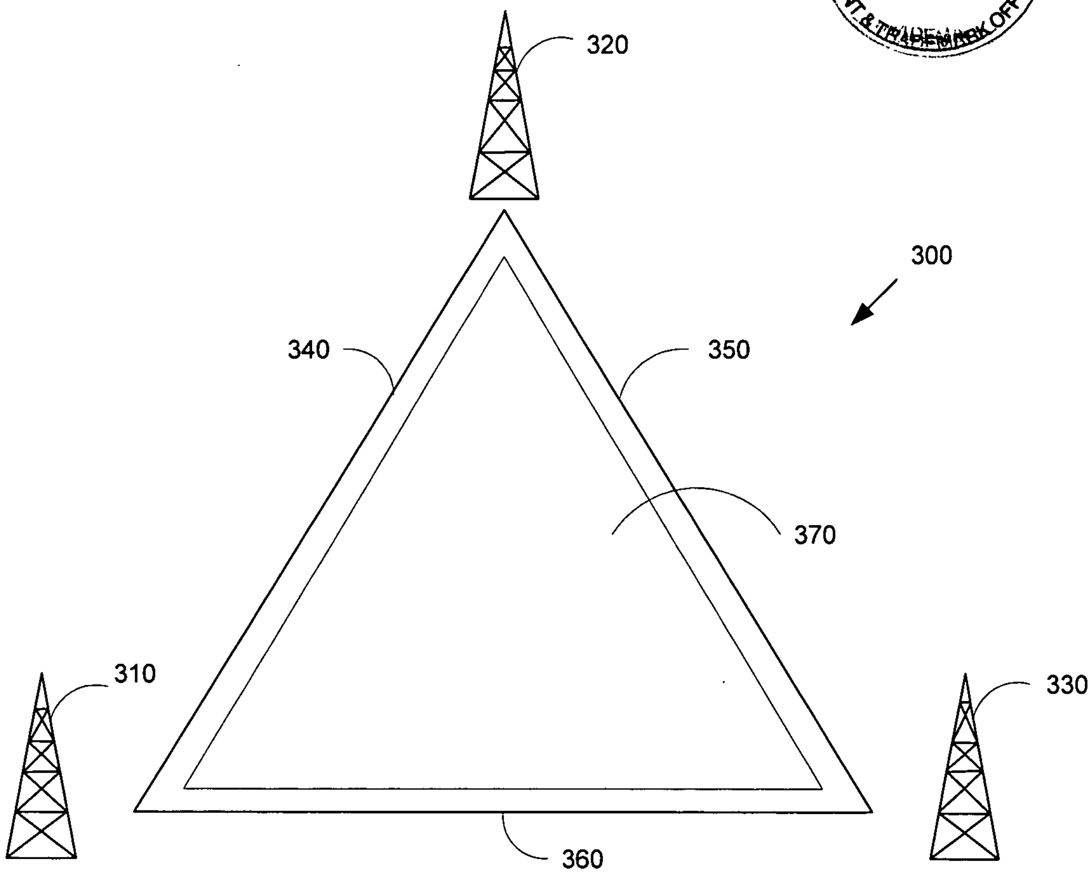

FIGURE 3
PRIOR ART

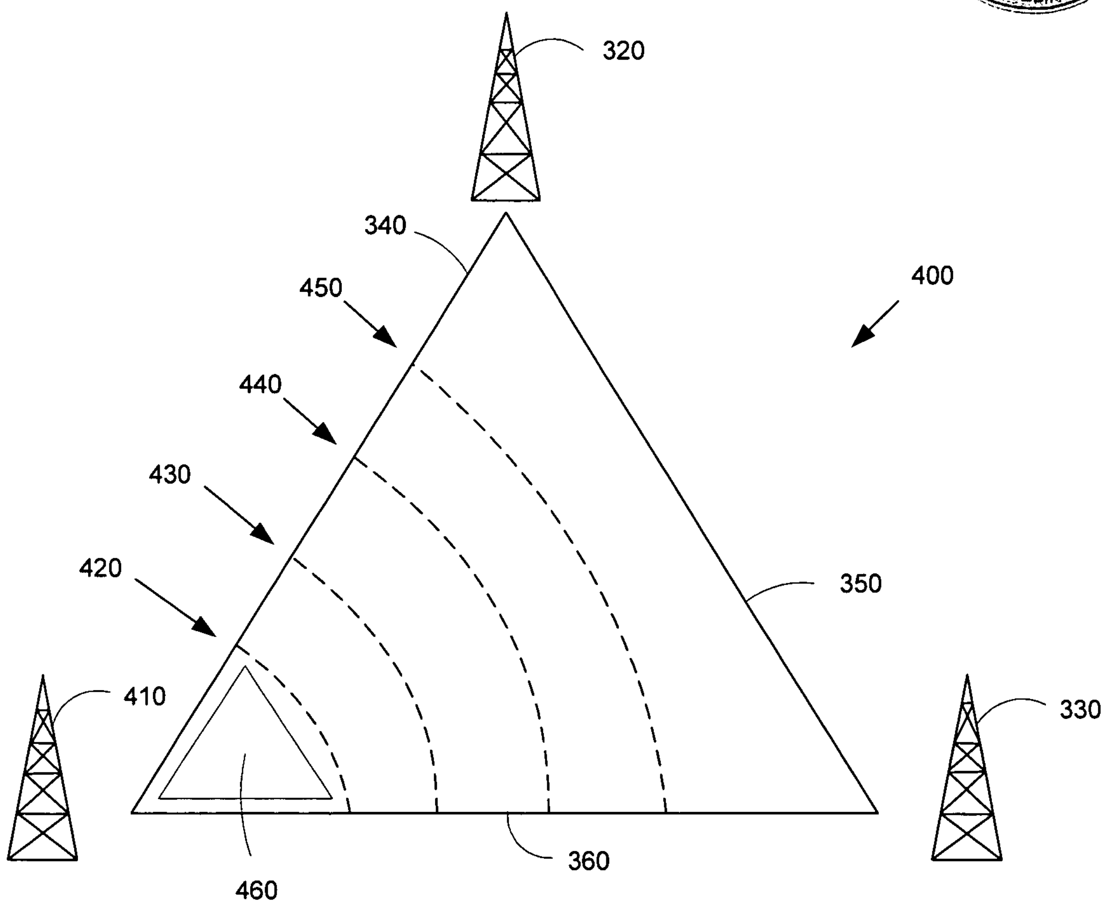

FIGURE 4

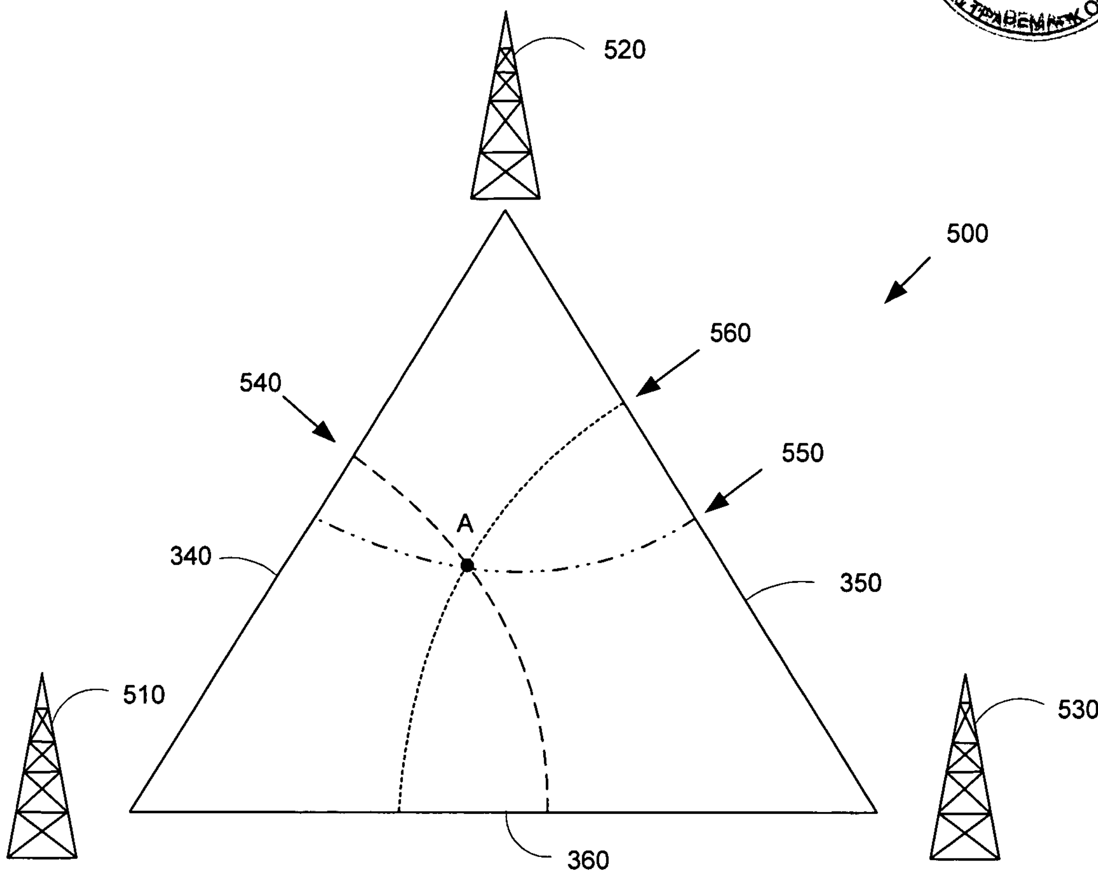

FIGURE 5

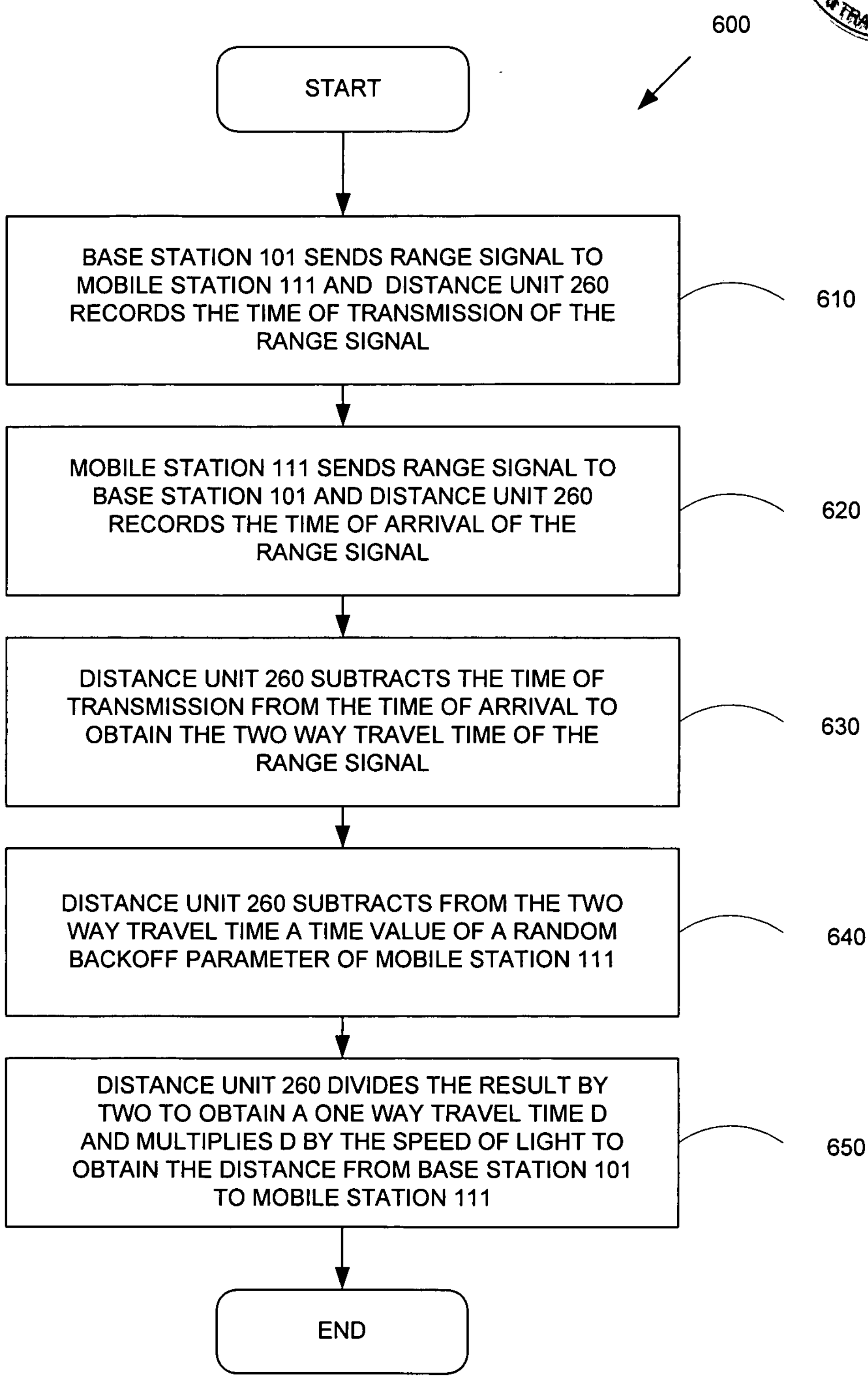
600
START
BASE STATION 101 SENDS RANGE SIGNAL TO MOBILE STATION 111 AND DISTANCE UNIT 260 RECORDS THE TIME OF TRANSMISSION OF THE RANGE SIGNAL
610
MOBILE STATION 111 SENDS RANGE SIGNAL TO BASE STATION 101 AND DISTANCE UNIT 260 RECORDS THE TIME OF ARRIVAL OF THE RANGE SIGNAL
620
DISTANCE UNIT 260 SUBTRACTS THE TIME OF TRANSMISSION FROM THE TIME OF ARRIVAL TO OBTAIN THE TWO WAY TRAVEL TIME OF THE RANGE SIGNAL
630
DISTANCE UNIT 260 SUBTRACTS FROM THE TWO WAY TRAVEL TIME A TIME VALUE OF A RANDOM BACKOFF PARAMETER OF MOBILE STATION 111
640
DISTANCE UNIT 260 DIVIDES THE RESULT BY TWO TO OBTAIN A ONE WAY TRAVEL TIME D AND MULTIPLIES D BY THE SPEED OF LIGHT TO OBTAIN THE DISTANCE FROM BASE STATION 101 TO MOBILE STATION 111
650
END

FIGURE 6

DOCKET NO. 2002.01.005.WS0
Client No. (SAMS01-00168)

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Purva R. Rajkotia
U.S. Serial No.:	10/028,571
Filed:	December 20, 2001
For:	SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK
Group No.:	2687
Examiner:	Eliseo Ramos-Feliciano

<u>APPENDIX C -</u>

Copy of Patent Application No.: 10/028,571 As Originally Filed

DOCKET NO. SAMS01-00168 PATENT

SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK

Inventor:

Purva R. Rajkotia
1414 Shiloh Road, No. 111
Plano
Collin County
Texas 75074
Citizen of India

OIPE IAP64
FEB 14 2006
PATENT & TRADEMARK OFFICE

Assignee:

SAMSUNG ELECTRONICS CO., LTD.
416, Maetan-dong, Paldal-gu
Suwon-city, Kyungki-do
Republic of Korea

CERTIFICATE OF EXPRESS MAIL

I hereby certify that this correspondence, including the attachments listed, is being deposited in an envelope addressed to the Assistant Commissioner of Patents, Washington, DC 20231 as "Express Mail, Post Office to Addressee" on the date indicated below.

Kathy Longenecker	EK742022099US
Printed Name of Person Mailing	Express Mail Label No.
Signature of Person Mailing	Date

William A. Munck
John T. Mockler
NOVAKOV, DAVIS & MUNCK, P.C.
900 Three Galleria Tower
13155 Noel Road
Dallas, Texas 75240
(214) 922-9221

SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK

TECHNICAL FIELD OF THE INVENTION

The present invention is directed, in general, to wireless telecommunications networks and, more specifically, to a system and method for locating a wireless station within a wireless network.

BACKGROUND OF THE INVENTION

The use of cellular telephones and wireless networks has become increasingly widespread. As the use of cellular telephones increase, it has become increasingly important for the operators of cellular telephone wireless networks to be able to determine the location of cellular telephones within a cellular telephone wireless network.

When a caller calls an emergency number such as 911 it is important to be able to tell exactly where the cellular telephone is located when the call is made. The Federal Communications Commission (FCC) has recently issued regulations that require operators of cellular telephone

networks to be able to locate a cellular telephone within a wireless network. The FCC Phase II requirements call for locating a cellular telephone to within three hundred (300) meters for ninety five percent (95%) of the calls.

One prior art system and method for locating a mobile station (such as a cellular telephone) within a wireless network measures signals transmitted from a mobile station and received at three or more base stations and calculates the position of the mobile station from the time of arrival (TOA) of the signals at the base stations. Another prior art system and method measures signals transmitted from a mobile station and received at three or more base stations and calculates the position of the mobile station from the time difference of arrival (TDOA) of the signals. Another prior art system and method calculates the position of the mobile station from the angle of arrival (AOA) of a signal transmitted from a mobile station to a base station.

The prior art systems and methods generally require the use of specialized equipment. For convenience, a unit of this specialized equipment will be referred to as a "position determining entity" or "PDE". The accuracy of the mobile station location calculated by the prior art

systems and methods is dependent upon the number of PDEs deployed in the wireless network.

A direct line between two PDEs is referred to as a "baseline". The Root Mean Square (RMS) location error is inversely proportional to the square root of the number of baselines. That is, the greater the number of baselines, the smaller the location error for locating the mobile station.

In prior art systems, the PDEs are normally located at the base stations of the wireless network and share the antennas with the base stations. If base station antennas are not available, a set of antennas must be constructed for the use of the PDEs. It is very expensive to construct a new set of antennas solely for use of PDEs.

If the number of baselines is too small, then the accuracy of the location of the mobile station will be low. In rural areas the number of baselines is small. This is because there are not many base stations because the subscriber base is small. Therefore in rural areas it will be very difficult to meet the FCC requirements for determining the location of mobile stations using any of the prior art systems and methods.

In addition, the prior art systems and methods for locating a mobile station within a wireless network require from three (3) minutes up to ten (10) minutes to locate a mobile station.

There is, therefore, a need in the art for an improved system and method for locating a mobile station within a wireless network. There is a need in the art for an improved system and method for locating a mobile station within a wireless network that does not require the use of specialized equipment such as PDEs. There is also a need in the art for an improved system and method that is capable of locating a mobile station within a wireless network in less time than that required by prior art systems.

SUMMARY OF THE INVENTION

To address the deficiencies of the prior art, it is a primary object of the present invention to provide, for use in wireless network, a system and method for locating a mobile station.

The present invention comprises a distance unit associated with a base station that is capable of utilizing a random backoff parameter of the mobile station to determine the distance from the base station to the mobile station. The distance unit determines a one way travel time of a range signal from the base station to the mobile station and multiplies the one way travel time by the speed of light in order to obtain the distance from the base station to the mobile station. The one way travel time is obtained from one half the value of a quantity that is equal to a two way travel time of a range signal minus a time value of a random backoff parameter of the mobile station. The distance resolution of the system is approximately two hundred forty four meters.

It is an object of the present invention to provide an improved system and method for locating a mobile station within a wireless network.

It is also an object of the present invention to provide an improved system and method for locating a mobile station within a wireless network that does not require the use of specialized equipment referred to as "position determining entities".

It is another object of the present invention to provide an improved system and method for locating a mobile station within a wireless network in less time than that required by prior art systems.

It is another object of the present invention to provide an improved system and method for locating a mobile station within an area between three base stations of the wireless network.

It is yet another object of the present invention to provide an improved system and method for locating a mobile station within a wireless network to within a distance resolution of approximately two hundred forty four meters.

The foregoing has outlined rather broadly the features and technical advantages of the present invention so that those skilled in the art may better understand the detailed description of the invention that follows. Additional features and advantages of the invention will be described hereinafter that form the subject of the claims of the

invention. Those skilled in the art will appreciate that they may readily use the conception and the specific embodiment disclosed as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. Those skilled in the art will also realize that such equivalent constructions do not depart from the spirit and scope of the invention in its broadest form.

Before undertaking the DETAILED DESCRIPTION OF THE INVENTION below, it may be advantageous to set forth definitions of certain words or phrases used throughout this patent document: the terms "include" and "comprise," as well as derivatives thereof, mean inclusion without limitation; the term "or" is inclusive, meaning and/or; the phrases "associated with" and "associated therewith," as well as derivatives thereof, may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, or the like; and the term "controller" means any device, system or part thereof that controls at least one operation, whether such a device is implemented in

hardware, firmware, software or some combination of at least two of the same. It should be noted that the functionality associated with any particular controller may be centralized or distributed, whether locally or remotely. Definitions for certain words and phrases are provided throughout this patent document, and those of ordinary skill in the art will understand that such definitions apply in many, if not most, instances to prior uses, as well as to future uses of such defined words and phrases.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, wherein like numbers designate like objects, and in which:

FIGURE 1 illustrates an exemplary prior art wireless network;

FIGURE 2 illustrates an exemplary base station comprising a distance unit capable of determining a distance of a mobile station from a base station in a wireless network in accordance with the principles of the present invention;

FIGURE 3 illustrates a triangular region in a prior art wireless network formed between three prior art base stations;

FIGURE 4 illustrates a triangular region of a wireless network formed between a base station comprising a distance unit of the present invention, and two prior art base stations;

FIGURE 5 illustrates a triangular region of a wireless network formed between three base stations in which each base station comprises a distance unit of the present invention; and

FIGURE 6 illustrates a flow chart of an advantageous embodiment of a method of the present invention for determining the distance of a mobile station from a base station in a wireless network.

DETAILED DESCRIPTION OF THE INVENTION

FIGURES 1 through 6, discussed below, and the various embodiments used to describe the principles of the present invention in this patent document are by way of illustration only and should not be construed in any way to limit the scope of the invention. Those skilled in the art will understand that the principles of the present invention may be implemented in any suitably arranged wireless network.

FIGURE 1 illustrates a general overview of an exemplary wireless network 100. The wireless telephone network 100 comprises a plurality of cell sites 121-123, each containing one of the base stations, BS 101, BS 102, or BS 103. Base stations 101-103 are operable to communicate with a plurality of mobile stations (MS) 111-114. Mobile stations 111-114 may be any suitable wireless communication devices, including conventional cellular telephones, PCS handsets, portable computers, telemetry devices, and the like, which are capable of communicating with the base stations via wireless links.

Dotted lines show the approximate boundaries of the cell sites 121-123 in which base stations 101-103 are

located. The cell sites are shown approximately circular for the purposes of illustration and explanation only. It should be clearly understood that the cell sites also may have irregular shapes, depending on the cell configuration selected and natural and man-made obstructions.

Each of the base stations BS 101, BS 102, and BS 103 may comprise a base station controller (BSC) and a base transceiver station (BTS). Base station controllers and base transceiver stations are well known to those skilled in the art. A base station controller is a device that manages wireless communications resources, including the base transceiver station, for specified cells within a wireless communications network. A base transceiver station comprises the RF transceivers, antennas, and other electrical equipment located in each cell site. This equipment may include air conditioning units, heating units, electrical supplies, telephone line interfaces, and RF transmitters and RF receivers, as well as call processing circuitry. For the purpose of simplicity and clarity in explaining the operation of the present invention, the base transceiver station in each of cells 121, 122, and 123 and the base station controller associated with each base transceiver station are

collectively represented by BS 101, BS 102 and BS 103, respectively.

BS 101, BS 102 and BS 103 transfer voice and data signals between each other and the public telephone system (not shown) via communications line 131 and mobile switching center (MSC) 140. Mobile switching center 140 is well known to those skilled in the art. Mobile switching center 140 is a switching device that provides services and coordination between the subscribers in a wireless network and external networks, such as the public telephone system and/or the Internet. Communications line 131 may be any suitable connection means, including a T1 line, a T3 line, a fiber optic link, a network backbone connection, and the like. In some embodiments, communications line 131 may be several different data links, where each data link couples one of BS 101, BS 102, or BS 103 to MSC 140.

In the exemplary wireless network 100, MS 111 is located in cell site 121 and is in communication with BS 101, MS 113 is located in cell site 122 and is in communication with BS 102, and MS 114 is located in cell site 123 and is in communication with BS 103. MS 112 is also located in cell site 121, close to the edge of cell site 123. The direction arrow proximate MS 112 indicates

the movement of MS 112 towards cell site 123. At some point, as MS 112 moves into cell site 123 and out of cell site 121, a "handoff" will occur.

As is well known, a handoff transfers control of a call from a first cell to a second cell. For example, if MS 112 is in communication with BS 101 and senses that the signal from BS 101 is becoming unacceptably weak, MS 112 may then switch to a base station that has a stronger signal, such as the signal transmitted by BS 103. MS 112 and BS 103 establish a new communication link and a signal is sent to BS 101 and the public telephone network to transfer the on-going voice, data, or control signals through BS 103. The call is thereby seamlessly transferred from BS 101 to BS 103. An "idle" handoff is a handoff between cells of a mobile device that is communicating in the control or paging channel, rather than transmitting voice and/or data signals in the regular traffic channels.

One or more of the wireless devices in wireless network 100 may be capable of executing real time applications, such as streaming audio or streaming video applications. Wireless network 100 receives the real time data from, for example, the Internet and transmits it in the forward channel to the wireless device. For example,

MS 112 may comprise a 3G cellular phone device that is capable of surfing the Internet and listening to streaming audio, such as music from the web site "www.mp3.com" or a sports radio broadcast from the web site "www.broadcast.com." MS 112 may also view streaming video from a news web site, such as "www.CNN.com." To avoid increasing the memory requirements and the size of wireless phone devices, one or more of the base stations in wireless network 100 provide real time data buffers that can be used to buffer real time data being sent to, for example, MS 112.

FIGURE 2 illustrates in greater detail exemplary base station 101. Base station 101 comprises base station controller (BSC) 210 and base transceiver station (BTS) 220. Base station controllers and base transceiver stations were described previously in connection with FIGURE 1. BSC 210 manages the resources in cell site 121, including BTS 220. BTS 220 comprises BTS controller 225, channel controller 235 with representative channel element 240, transceiver interface (IF) 245, RF transceiver unit 250, and antenna array 255.

BTS controller 225 comprises processing circuitry and memory capable of executing an operating program that

controls the overall operation of BTS 220 and communicates with BSC 210. Under normal conditions, BTS controller 225 directs the operation of channel controller 235, which contains a number of channel elements, including channel element 240, that perform bi-directional communications in the forward channel and the reverse channel. A "forward" channel refers to outbound signals from the base station to the mobile station and a "reverse" channel refers to inbound signals from the mobile station to the base station. Transceiver IF 245 transfers the bi-directional channel signals between channel controller 235 and RF transceiver unit 250.

Antenna array 255 transmits forward channel signals received from RF transceiver unit 250 to mobile stations in the coverage area of BS 101. Antenna array 255 also sends to transceiver 250 reverse channel signals received from mobile stations in the coverage area of BS 101. In one embodiment, antenna array 255 may comprise a multi-sector antenna, such as a three sector antenna in which each antenna sector is responsible for transmitting and receiving in a one hundred twenty degree (120°) arc of coverage area. Additionally, RF transceiver 250 may contain

an antenna selection unit to select among different antennas in antenna array 255 during both transmit and receive operations.

BTS controller 225 comprises distance unit 260 of the present invention. Distance unit 260 calculates a one way travel time D for a signal to travel to a mobile station (for example, mobile station 111 designated MS1) from base station 101 using the equation:

$$D = \frac{1}{2}\left[\left(two\ way\ travel\,time\right) - \left(random backoff\right) \right] \qquad (1)$$

where the two way travel time is a time measured in nanoseconds (ns) and where the random backoff is a chip length that is converted to time in nanoseconds (ns). The one way travel time D is expressed in nanoseconds (ns). A nanosecond is one billionth of a second (10^{-9} sec).

The random backoff parameter used in Equation (1) is specified in the IS-95 Code Division Multiple Access (CDMA) standard for CDMA networks (the "Standard"). The time duration of one binary digit (referred to as one "chip" or one "chip length") equals the reciprocal of the bandwidth of the CDMA system. A value of 1.2288 MHz for the bandwidth of the CDMA system causes the chip length to be eight hundred thirteen and eight tenths nanoseconds (813.8 ns).

The random backoff parameter for mobile station MS1 represents a time duration after which mobile station MS1 starts a transmission. Depending upon the distance between mobile station 111 (MS1) and the base station BS 101, a mobile station may have a random backoff parameter with a chip length value of zero (0) up to a chip length value of five hundred eleven (511). As specified in the Standard, the random backoff parameter is calculated from the equation:

$$\textit{Random Backoff} = 2^{PNRAN} - 1 \qquad (2)$$

where PNRAN is a pseudo noise random number having a value from zero (0) to nine (9). When PNRAN equals zero (0), the random backoff parameter equals zero (0). When PNRAN equals nine (9), the random backoff parameter equals five hundred eleven (511).

Whenever a mobile station originates a call on an access channel, the call attempt will be delayed for a time that is proportional to the distance of the mobile station from the base station. As described in the IS-95 CDMA Standard, the precise timing of an access channel transmission in an access attempt is determined by a procedure called PN (Pseudo Noise) randomization. For each

access sub-attempt the PN randomization process computes RN (a PN randomization delay) as using a hash function. The hash function employs a hash key called RN_HASH_KEY that has a value between zero (0) and $2^{PROBE\_PN\_RAN} - 1$. The value of the quantity PROBE_PN_RAN is dependent upon parameters such as PD (persistence delay), RA (random access channel number), RS (sequence backoff), and RT (probe backoff). One may consult the IS-95 CDMA Standard for additional details concerning PN (Pseudo Noise) randomization.

The PN randomization process uses the value of RN (a PN randomization delay) to determine the value of PNRAN that is used in Equation (2) to calculate the value of the random backoff parameter. The random backoff parameter of the mobile station represents the time offset after which the mobile station starts a transmission. The random backoff parameter of the mobile station is proportional to the distance of the mobile station from the base station. The mobile station continually informs the base station of the current value of the random backoff parameter for the mobile station.

In order to calculate the distance of mobile station 111 from base station 101 distance unit 260 uses a two way travel time of a range signal sent to and from the mobile

station, and the random backoff parameter of the mobile station. A range signal is a signal sent from base station 101 to locate mobile station 111.

To calculate the two way travel time of the range signal to and from mobile station 111 distance unit 260 records the time of transmission of the range signal to mobile station 111. In response to receiving the range signal mobile station 111 sends a range signal transmission back to base station 101. Distance unit 260 records the time of arrival of the range signal transmission from mobile station 111. Distance unit 260 then subtracts the time of transmission from the time of arrival to obtain the two way travel time in nanoseconds.

Distance unit 260 then accesses the value of the random backoff parameter for mobile station 111 (designated MS1). Distance unit 260 then expresses the value of the random backoff parameter in nanoseconds using the fact that one chip length is equal to eight hundred thirteen and eight tenths nanoseconds (813.8 ns). Distance unit 260 then subtracts the value of the random backoff parameter in nanoseconds from the value of the two way travel time in nanoseconds. Distance unit 260 then divides the result by two (2) to obtain the one way travel time D

in nanoseconds for a signal to travel from base station 101 to mobile station 111 (or vice versa).

The radio signal travels to and from mobile station 111 at the speed of light. The speed of light is 299,792,458 meters per second or 0.299,792,458 meters per nanosecond. Distance unit 260 multiplies the one way travel time D in nanoseconds for a signal to travel from base station 101 to mobile station 111 by the speed of light to obtain the distance from base station 101 to mobile station 111. One chip length of eight hundred thirteen and eight tenths nanoseconds (813.8 ns) corresponds to approximately two hundred forty four meters (244 m). The time resolution of distance unit 260 is one chip length. Therefore, distance unit 260 can locate the range of mobile station 111 from base station 101 to within two hundred forty four meters (244 m).

The time required for distance unit 260 to determine the distance from base station 101 to mobile station 111 is on the order of a few seconds. Distance unit 260 can determine the distance from base station 101 to mobile station 111 in less than ten (10) seconds. Prior art systems require longer times to accomplish the same result and may take as long ten (10) minutes. The present

invention provides a significant improvement over the prior art in the time required to determine the distance of a mobile station from a base station. The present invention also provides a significant improvement over the prior art in that the present invention determines the distance of a mobile station from a base station using a random backoff parameter. No external specialized equipment is needed.

The present invention may be adapted to compensate for multipath signals. A multipath signal can arrive either earlier or later than a direct signal. Therefore a multipath signal can create either a positive or negative signal delay T with respect to the arrival of a direct signal. To use a multipath signal to determine the one way travel time D the signal delay T can be added to or subtracted from the two way travel time to compensate for the effect of the multipath time difference. After the multipath time difference has been corrected for, the one way distance is calculated in the manner previously described.

Similarly, the present invention may also be adapted to compensate for Doppler effects. As is well known, Doppler effect are frequency shifts that are caused by the

motion of a transmitting mobile station toward or away from the base station.

To use a Doppler shifted signal to determine the one way travel time D, the amount of Doppler shift is first translated into a corresponding Doppler time period T_D. The Doppler time period T_D is then added to or subtracted from the two way travel time to compensate for the effect of the Doppler time difference. After the Doppler time difference has been corrected for, the one way distance is calculated in the manner previously described.

It is noted that similar corrections may be made to compensate for other types of signal conditions that cause a time difference in the arrival of a signal at a base station.

FIGURE 3 illustrates a prior art triangular region 300 between a first base station 310, a second base station 320 and a third base station 330. Baseline 340 extends from first base station 310 to second base station 320. Baseline 350 extends from second base station 320 to third base station 330. Baseline 360 extends from third base station 330 to first base station 310.

A signal from a mobile station located within the triangle formed by the three baselines 340, 350 and 360 reaches the three base stations 310, 320 and 330. The shaded triangular portion 370 represents a region in which the location of the mobile station is unknown. The prior art system shown in FIGURE 3 is not able to locate a mobile station. Therefore, the location of a mobile station within the shaded triangular portion 370 is completely unknown. The shaded triangular portion 370 is coextensive with the triangle formed by the three baselines 340, 350 and 360.

FIGURE 4 illustrates a similar triangular region 400 between a first base station 410 comprising distance unit 260 of the present invention, a prior art second base station 320 and a prior art third base station 330. Triangular region 400 also comprises the three baselines, 340, 350 and 360, shown in FIGURE 3, except that base station 310 of FIGURE 3 has been replaced by base station 410 in FIGURE 4. First base station 410 in FIGURE 4 is capable of determining the distance of a mobile station from base station 410 in accordance with the principles of the present invention.

Arc 420 represents a distance from base station 410 that corresponds to two hundred forty four meters (244 m),

the minimum resolution distance for distance unit 260. The distance of two hundred forty four meters (244 m) will be referred to as a "basic unit" of distance. If a mobile station is closer to base station 410 than two hundred forty four meters (244 m), then distance unit 260 will not be able to determine the distance to the mobile station. The shaded triangular portion 460 represents a region in which the location of the mobile station is unknown to base station 410.

Arc 430, arc 440 and arc 450 represent distances from base station 410 that respectively correspond to two, three and four basic units of distance. Additional arcs (not shown) may represent additional distances from base station 310 that are integral multiples of the basic unit of distance.

The distance information represented by arc 420, arc 430, arc 440 and arc 450 may be used to identify distance zones within triangular region 400. The fact that a mobile station may be located to within approximately two hundred forty meters from a base station allows the creation of distance zones based on the distance from the base station. Zone based services may be based upon the location of mobile station within a particular distance

zone. For example, Quality of Service (QoS) may be provided to mobile station users based upon the zone in which the mobile station is located. Users who are located in a distance zone close to the base station may be guaranteed higher levels of QoS than users who are farther away from the base station.

FIGURE 5 illustrates a triangular region 500 between a first base station 510, a second base station 520 and a third base station 530. Triangular region 500 also comprises the three baselines 340, 350 and 360 shown in FIGURE 3, except that base stations 310, 320 and 330 in FIGURE 3 have been replaced by base stations 510, 520 and 530 in FIGURE 5. First base station 510, second base station 520 and third base station 530 in FIGURE 5 are each provided with a distance unit 260 of the present invention. Each of the three base stations 510, 520 and 530 are capable of determining the distance to a mobile station within triangular region 500.

In this advantageous embodiment of the present invention, a specific location of a mobile station (indicated by the letter A in FIGURE 5) may be determined to within the resolution of the basic unit of distance of two hundred forty four meters (244m). As shown in FIGURE 5,

arc 540 locates the distance of the mobile station from base station 510. Arc 550 locates the distance of the mobile station from base station 520. Arc 560 locates the distance of the mobile station from base station 330. The three arcs cross at the location of the mobile station. The location of the mobile station is designated point A.

The location of point A may be calculated in distance unit 260 of base station 510, or in distance unit of base station 520, or in distance unit 260 of base station 530. The base station that calculates the location of point A (e.g., base station 510) receives from the other base stations (e.g., base station 520 and base station 530) information concerning the distance of the mobile station from the other two base stations.

Alternatively, the location of point A may be calculated in a separate calculator unit (not shown) at a remote location not within base station 510, base station 520, or base station 530. The separate calculator unit must receive information from each of the three base stations 510, 520 and 530, concerning the distance of the mobile station from the base station.

Three arcs are used to locate the mobile station because using only two arcs would lead to an ambiguous

result due to the fact that any two of the arcs also cross at a second point outside of the triangular region 500. The use of three arcs removes all ambiguity in the location of the mobile station.

FIGURE 6 illustrates a flowchart of an advantageous embodiment of a method of the present invention for determining the distance of a mobile station from a base station. The steps of the method are generally denoted with reference numeral 600. Base station 101 sends a range signal to mobile station 111 and distance unit 260 records the time of transmission of the range signal (step 610).

Mobile station 111 then sends a range signal to base station 101 and distance unit 260 records the time of arrival of the range signal at base station 101 (step 620). Distance unit 260 then subtracts the time of transmission of the range signal to mobile station 111 from the time of arrival of the range signal from mobile station 111 to obtain the two way travel time of the range signal (step 630). The two way travel time is expressed in nanoseconds.

Distance unit 260 subtracts from the two way travel time a time value of the random backoff parameter of mobile station 111 (step 640). As previously explained, the time

value of the random backoff parameter is expressed in nanoseconds where one chip length is equal to eight hundred thirteen and eight tenths nanoseconds (813.8 ns).

Distance unit 260 divides the result by two (2) to obtain a one way travel time D and then multiplies the one way travel time D by the speed of light to obtain the distance from base station 101 to mobile station 111 (step 650).

It is important to note that while the present invention has been described in the context of a fully functional network device, those skilled in the art will appreciate that the mechanism of the present invention is capable of being implemented and distributed in the form of a computer usable medium of instructions in a variety of forms, and that the present invention applies equally regardless of the particular type of signal bearing medium used. Examples include, but are not limited to: nonvolatile, hard-coded or programmable type mediums such as read only memories (ROMs) or erasable, electrically programmable read only memories (EEPROMs), recordable type mediums such as floppy disks, hard disk drives, and read/write (R/W) compact disc read only memories (CD-ROMs)

or digital versatile discs (DVDs), and transmission type mediums such as digital and analog communications links.

Although the present invention has been described in detail, those skilled in the art will understand that various changes, substitutions, and alterations herein may be made without departing from the spirit and scope of the invention it its broadest form.

WHAT IS CLAIMED IS:

1. For use in wireless network communications system comprising a plurality of base stations and a plurality of mobile stations, an apparatus for determining a distance from a base station to a mobile station, said apparatus comprising:

a distance unit associated with said base station wherein said distance unit is capable of determining a one way travel time D of a signal from said base station to said mobile station; and

wherein said distance unit is capable of multiplying said one way travel time D by the speed of light to obtain said distance from said base station to said mobile station.

2. The apparatus as set forth in Claim 1 wherein said distance unit is capable of determining said one way travel time D from:

$$D = \frac{1}{2}\left[\left(\textit{two way travel time}\right) - \left(\textit{random backoff}\right)\right]$$

wherein said two way travel time is a time of travel for a range signal to travel from said base station to said mobile station and to travel from said mobile station to said base station; and

wherein said random backoff is a time value of a chip length of a random backoff parameter of said mobile station.

3. The apparatus as set forth in Claim 2 wherein said distance unit is capable of obtaining said two way travel time by subtracting an arrival time of said range signal at said base station from said mobile station from a transmission time of said range signal from said base station to said mobile station.

4. The apparatus as set forth in Claim 2 wherein said random backoff parameter for said mobile station has a chip length value between zero chip lengths and five hundred eleven chip lengths.

5. The apparatus as set forth in Claim 4 wherein a time value for one chip length value is eight hundred thirteen and eight tenths nanoseconds.

6. The apparatus as set forth in Claim 1 wherein said distance unit is capable of obtaining a distance from said base station to said mobile station with a distance resolution of approximately two hundred forty four meters.

7. The apparatus as set forth in Claim 2 wherein said distance unit is capable of adjusting a value of said two way travel time to correct a time difference of a signal comprising one of: a multipath signal and a Doppler shifted signal.

8. A wireless network communications system comprising a base station and a mobile station, said base station comprising an apparatus for determining a distance from said base station to said mobile station, said apparatus comprising:

a distance unit associated with said base station wherein said distance unit is capable of determining a one way travel time D of a signal from said base station to said mobile station; and

wherein said distance unit is capable of multiplying said one way travel time D by the speed of light to obtain said distance from said base station to said mobile station.

9. The wireless network communications system as set forth in Claim 8 wherein said distance unit is capable of determining said one way travel time D from:

$$D = \frac{1}{2}\left[\left(\textit{two way travel time}\right) - \left(\textit{random backoff}\right)\right]$$

wherein said two way travel time is a time of travel for a range signal to travel from said base station to said mobile station and to travel from said mobile station to said base station; and

wherein said random backoff is a time value of a chip length of a random backoff parameter of said mobile station.

10. The wireless network communications system as set forth in Claim 9 wherein said distance unit is capable of obtaining said two way travel time by subtracting an arrival time of said range signal at said base station from said mobile station from a transmission time of said range signal from said base station to said mobile station.

11. The wireless network communications system as set forth in Claim 9 wherein said random backoff parameter for said mobile station has a chip length value between zero chip lengths and five hundred eleven chip lengths.

12. The wireless network communications system as set forth in Claim 11 wherein a time value for one chip length value is eight hundred thirteen and eight tenths nanoseconds.

13. The wireless network communications system as set forth in Claim 8 wherein said distance unit is capable of obtaining a distance from said base station to said mobile station with a distance resolution of approximately two hundred forty four meters.

14. The wireless network communications system as set forth in Claim 9 wherein said distance unit is capable of adjusting a value of said two way travel time to correct a time difference of a signal comprising one of: a multipath signal and a Doppler shifted signal.

15. For use in wireless network communications system comprising a base station and a mobile station, a method of determining a distance from said base station to said mobile station comprising the steps of:

determining with a distance unit associated with said base station a one way travel time D of a signal from said base station to said mobile station; and

multiplying said one way travel time D by the speed of light to obtain said distance from said base station to said mobile station.

16. The method as set forth in Claim 15 wherein the step of determining with a distance unit associated with said base station a one way travel time D of a signal from said base station to said mobile station comprises the step of:

calculating said one way travel time D from:

$$D = \frac{1}{2}\left[\left(\textit{two way travel time}\right) - \left(\textit{random backoff}\right)\right]$$

wherein said two way travel time is a time of travel for a range signal to travel from said base station to said mobile station and to travel from said mobile station to said base station; and

wherein said random backoff is a time value of a chip length of a random backoff parameter of said mobile station.

17. The method as set forth in Claim 16 further comprising the step of:

obtaining said two way travel time by subtracting an arrival time of said range signal at said base station from said mobile station from a transmission time of said range signal from said base station to said mobile station.

18. The method as set forth in Claim 16 wherein said random backoff parameter for said mobile station has a chip length value between zero chip lengths and five hundred eleven chip lengths.

19. The method as set forth in Claim 18 wherein a time value for one chip length value is eight hundred thirteen and eight tenths nanoseconds.

20. The method as set forth in Claim 15 further comprising the step of:

obtaining with said distance unit a distance from said base station to said mobile station with a distance resolution of approximately two hundred forty four meters.

21. The method as set forth in Claim 16 further comprising the step of:

adjusting in said distance unit a value of said two way travel time to correct a time difference of a signal comprising one of: a multipath signal and a Doppler shifted signal.

22. The method as set forth in Claim 15 wherein said distance unit determines a distance from said base station to said mobile station in less than ten seconds.

23. For use in wireless network communications system comprising a plurality of base stations and a plurality of mobile stations, a method for locating a mobile station in an area between three base stations, said method comprising the steps of:

determining with a distance unit associated with each of said three base stations a one way travel time D of a signal from each respective station to said mobile station where

$$D = \frac{1}{2} \left[(\textit{two way travel time}) - (\textit{random backoff}) \right]$$

wherein said two way travel time is a time of travel for a range signal to travel from each respective base station to said mobile station and to travel from said mobile station to each respective base station;

wherein said random backoff is a time value of a chip length of a random backoff parameter of said mobile station;

multiplying each respective one way travel time D by the speed of light to obtain each respective distance from each respective base station to said mobile station; and

identifying a location of said mobile station within said area between said three base stations using said

respective distances of said mobile station from said respective base stations.

24. The method as set forth in Claim 23 wherein said location of said mobile station within said area between said three base stations has a distance resolution of approximately two hundred forty four meters.

25. The method as set forth in Claim 23 wherein the step of identifying said location of said mobile station within said area between said three base stations using said respective distances of said mobile station from said respective base stations comprises the steps of:

providing said respective distances of said mobile station from said respective base stations to a distance unit within one of said three base stations; and

calculating in said distance unit a location of said mobile station from said respective distances of said mobile station from said respective base stations.

26. The method as set forth in Claim 23 wherein the step of identifying said location of said mobile station within said area between said three base stations using said respective distances of said mobile station from said respective base stations comprises the steps of:

providing said respective distances of said mobile station from said respective base stations to a calculator unit not located within said three base stations; and

calculating in said calculator unit a location of said mobile station from said respective distances of said mobile station from said respective base stations.

27. For use in wireless network communications system comprising a plurality of base stations and a plurality of mobile stations, an apparatus for locating a mobile station in an area between three base stations, said apparatus comprising:

a distance unit associated with each of said three base stations wherein said distance unit is capable of determining a one way travel time D of a signal from each respective station to said mobile station where

$$D = \frac{1}{2} \left[\left(\textit{two way travel time} \right) - \left(\textit{random backoff} \right) \right]$$

wherein said two way travel time is a time of travel for a range signal to travel from each respective base station to said mobile station and to travel from said mobile station to each respective base station;

wherein said random backoff is a time value of a chip length of a random backoff parameter of said mobile station;

wherein said distance unit is capable of multiplying each respective one way travel time D by the speed of light to obtain each respective distance from each respective base station to said mobile station; and

wherein said distance unit is capable of identifying a location of said mobile station within said area between said three base stations using said respective distances of said mobile station from said respective base stations.

28. The apparatus as set forth in Claim 27 wherein said location of said mobile station within said area between said three base stations has a distance resolution of approximately two hundred forty four meters.

29. The apparatus as set forth in Claim 27 wherein said distance unit is capable of calculating a location of said mobile station from said respective distances of said mobile station from said respective base stations.

30. The apparatus as set forth in Claim 27 further comprising:

a calculator unit coupled to said three base stations but not located within said three base stations, said calculator unit capable of receiving from said three base stations said respective distances of said mobile station from said respective base stations;

wherein said calculator unit is capable of calculating a location of said mobile station from said respective distances of said mobile station from said respective base stations.

SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK

ABSTRACT OF THE DISCLOSURE

A system and method is disclosed for locating a mobile station in a wireless network. A distance unit associated with a base station determines a one way travel time of a range signal from the base station to the mobile station and multiplies the one way travel time by the speed of light to obtain the distance from the base station to the mobile station. The one way travel time is equal to one half of a quantity that is equal to a two way travel time of a range signal minus a time value of a random backoff parameter of the mobile station. The distance resolution of the system is approximately two hundred forty four meters.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Purva R. Rajkotia
U.S. Serial No.:	10/028,571
Filed:	December 20, 2001
For:	SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK
Group No.:	2687
Examiner:	Eliseo Ramos-Feliciano

APPENDIX D -

Evidence Appendix

Not Applicable – No evidence outside the prosecution history is relied upon.

DOCKET NO. 2002.01.005.WS0
Client No. (SAMS01-00168)

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Purva R. Rajkotia
U.S. Serial No.:	10/028,571
Filed:	December 20, 2001
For:	SYSTEM AND METHOD FOR LOCATING A MOBILE STATION IN A WIRELESS NETWORK
Group No.:	2687
Examiner:	Eliseo Ramos-Feliciano

APPENDIX E -

Related Proceedings Appendix

Not Applicable – To the best knowledge and belief of the undersigned attorney, there are none.